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ACTIVATION PLAN FOR LAUNCH COMPLEX 19 AND THE LAUNCH VEHICLE SUPPORT AREA

PREPARED BY

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ACTIVATION PLAN FOR LAUNCH COMPLEX 19 AND THE LAUNCH VEHICLE SUPPORT AREA.

VOLUME I

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FOREWORD

This revision to the Gemini launch vehicle activation plan for Launch Complex 19 and the launch vehicle support area, Engineering Report 12211, has been prepared by the Martin Company, Space Systems Division of the Martin Marietta Corporation, in response to a letter directive from the Air Force dated 5 June 1962. As directed, the revision was prepared in accordance with the requirements of AF/SSD Exhibit 61-46, "Documentation for Facility Activation in Support of USAF Space Programs," dated 1 August 1961.

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1.0 INTRODUCTION

This document presents a description of all major activation events that must occur from the moment of contract award through launch complex verification to provide a complex from which the Gemini spacecraft can be successfully launched.

The body of this text, Volume I, presents a description of the sequential steps that will be followed during modification of the launch complex and installation and checkout of the AGE. Volume II contains the schedules for the operations described in Volume I. The two volumes are arranged so that cross references can readily be made.

In order that Launch Complex 19 may be modified to meet the requirements of the Gemini program, modification will be accomplished based upon a definitive A&E design in accordance with Engineering Report 12053, "Launch Complex Design Criteria." The Corps of Engineers will be responsible for facility construction and attendant test programs. Launch complex modification will be subject to Air Force control.

The Martin Company, as Integrating Contractor, is directly responsible for the installation and checkout of all launch vehicle AGE and for installation of spacecraft AGE; the establishment of all activation procedures and coordination with the Air Force; monitoring and scheduling changes to AGE; and coordinating the efforts of all associate contractors. In addition, the Martin Company will participate in final acceptance negotiation of the completed activation program with Air Force.

This two-volume report shows how these activities have been planned to provide for an efficient activation of the Gemini launch complex.

GLOSSARY OF ABBREVIATIONS

ABETS	Airborne Beacon Equipment Test Set
AFMTC	Air Force Missile Test Center
AF/SSD	Air Force/Space Systems Division
AGC	Automatic Gain Control
AGE	Aerospace Ground Equipment
AMR	Atlantic Missile Range
APS	Accessory Power System
CB	Circuit Breaker
CCMTA	Cape Canaveral Missile Test Annex
CCTV	Closed Circuit Television
COE	Corps of Engineers
CP	Control Point
CVE	Complete Vehicle Erector
CVUT	Complete Vehicle Umbilical Tower
ECS	Environmental Control System
EPS	Electrical Power System
FCS	Flight Control System
FCSTS	Flight Control System Test Set
FRF	Flight Readiness Firing
GFE	Government-Furnished Equipment
GFP	Government-Furnished Property
GHe	Gaseous Helium
GIE	Ground Instrumentation Equipment

GN_2	Gaseous Nitrogen
GOX	Gaseous Oxygen
GSTP	Ground System Test Procedure
IMU	Inertial Measuring Unit
IPS	Instrumentation Power System
LH_2	Liquid Hydrogen
LN_2	Liquid Nitrogen
LOX	Liquid Oxygen
LPUT	Launch Position Umbilical Tower
LVRCS	Launch Vehicle Release Control Set
LVSSTS	Launch Vehicle Safety System Test Set
MCC	Motor Control Center
MDS	Malfunction Detection System
MDSTS	Malfunction Detection System Test Set
MG	Motor Generator
MISTRAM	Missile Trajectory Measurement
MOCS	Master Operations Control System
N_2	Gaseous Nitrogen
NASA	National Aeronautics and Space Administration
NEC	National Electrical Code
OAMS	Orbital Attitude Maneuvering System
OGE	Operating Ground Equipment
OTCU	Oxidizer Transfer Control Unit
PCM	Pulse Code Modulation

PCS	Propulsion Control Set
PDCS	Power Distribution Control Set
PSCC	Propellant System Control Console
PSCS	Propellant System Control Set
PTPS	Propellant Transfer and Pressurization System
RCS	Reaction Control System
RSV	Ready Storage Vessel
SCAPE	Self-contained Atmospheric Protective Ensemble
SCF	Sequenced Compatibility Firing
SMR	Spin Motor Rotation
SRO	Superintendent of Range Operations
SSE	Second-Stage Erector
SSUT	Second-Stage Umbilical Tower
TP	Turning Point
TPUT	Test Position Umbilical Tower
TR	Terminal Rack
TSW	Transfer Switch
USAF	United States Air Force
VCO	Voltage Control Oscillator
VTF	Vertical Test Facility (at Baltimore)

2.0 CONTRACT AWARD

AF/SSD Contract No. AF04(695)-88 for the Gemini launch vehicle program was awarded to the Martin Marietta Corporation on 19 January 1962.

The Martin Company, Space Systems Division of the Martin Marietta Corporation,has been assigned the responsibility of integrating all activation efforts associated with this program on Complex 19 and the booster support area at AMR.

3.0 REVIEW AND APPROVAL

Those areas of the activation plan which required coordination between the various individual agencies and Martin, acting as Integrating Contractor, were reviewed and approved by the affected agencies prior to submission of this plan to the Air Force.

Specifically, the five following areas were considered:

(1) Launch complex modification schedule.

(2) Spacecraft servicing equipment installation and delivery schedule.

(3) Launch vehicle guidance system checkout equipment installation and delivery schedule.

(4) Installation of Martin AGE racks and consoles which contain controls for certain engine servicing functions.

(5) Engine servicing equipment installation and delivery schedule.

(6) Checkout schedule for AGE and facility items furnished by other agencies.

This document will be maintained on an as-required basis after review and approval by the Air Force. Changes will be made to reflect only significant changes in the activation effort, such as major revisions to the various AGE systems.

4.0 GOVERNMENT-FURNISHED UTILITIES AND SERVICES

Certain utilities, services and facilities required to support Launch Complex 19 activation will be supplied by AFMTC. In general, these requirements embrace such areas as technical operations; logistic support; security and commissary administration; data acquisition and support; medical services; and general office, storage, laboratory, test and support space. A more detailed discussion of support requirements will be found in Martin Specification MB 1051, paragraph 3.1.3.2.

5.0 FACILITY CONVERSION STUDY AND DEACTIVATION PLANNING

After Martin was assigned as Integrating Contractor, a study was made of the Titan I configuration of Launch Complex 19 and the launch vehicle support area to determine the revisions and additions required to meet the Gemini program requirements. The results of this study are contained in Martin Engineering Report 12053A, "Facility Design Criteria," dated 20 April 1962. Three addenda to this report have been issued as of 10 October 1962.

A study of the Titan I AGE available at AMR for the Gemini program showed that the equipment could be divided into the following four categories.

(1) AGE usable "as is."

(2) AGE not required for Gemini program.

(3) AGE that could be modified to meet Gemini program requirements.

(4) AGE that could be modernized or refurbished to meet Gemini requirements.

The disposition of AGE not required for the Gemini program is described in Engineering Report 12210A, "Deactivation Plan for Launch Complex 19," dated 7 March 1962.

A study of Launch Complex 19 as it existed for the Titan I program and the findings presented in Engineering Report 12053A, "Facility Design Criteria," illustrated that certain facility items required revision to meet Gemini program requirements. The nature of these revisions is described in Engineering Report 12210A, "Deactivation Plan for Launch Complex 19," dated 7 March 1962.

The tearout portion of the deactivation effort was completed on 13 April 1962.

6.0 DESCRIPTION OF FACILITY MODIFICATIONS

Launching of the Gemini spacecraft will be from Launch Complex 19, a former Titan I launch facility at CCMTA, Cape Canaveral, Florida, which is being modified to meet the facility requirements of this program. Since the Gemini launch vehicle is similar to Titan II, a number of these modifications are similar to those which were accomplished during changeover of former Titan I launch complexes to meet Titan II requirements.

Inasmuch as the program is man-rated and captive firing tests will be performed on the launch pad, the Titan II facility modification parameters will be revised accordingly, and additional facilities will be provided to meet the requirements of the complete system test and launch operations.

Under Air Force direction, the Martin Company has prepared design criteria which have been used in effecting the design of modifications to the launch complex. The design criteria are an integration of facility requirements established by the various associate contractors.

Using the design criteria for guidance, Rader and Associates has prepared through a facility design contract, drawings and specifications relative to the modification of the launch complex facilities. During the design phase, technical assistance was provided to the designers by the using organizations. If necessary, the same organizations will provide technical assistance to the COE during actual modification work.

Additional items of work outside of the immediate area of Complex 19 are included in contractual drawings and specifications related to the complex facility modification work. These items (e.g., propellant tankage at the tank farm and an extension to the ICBM road northwest of Complex 20) are indirectly related to the Gemini program but are not considered as part of the facility modifications of Complex 19.

The actual modification effort will be directed by the Corps of Engineers.

6.1 DESIGN CRITERIA, DRAWINGS AND SPECIFICATIONS

6.1.1 Martin Company

The design criteria for launch complex facility modifications are published in Martin Company Engineering Report 12053A, dated 20 April 1962, along with addenda.

6.1.2 NASA

The design drawings and specifications detailing complex facility modifications are published under Specification No. (NASA)-080123-63-1.

6.1.3 Rader and Associates

Rader and Associates drawing numbers referenced in this document have letter prefixes (C, S, M and E) denoting civil, structural, mechanical and electrical, respectively.

6.2 SITE PREPARATION

Additions to existing facilities and construction of new facilities for Gemini require that additional site improvement work be accomplished in the complex area. Location of this work is outlined in Drawing C-2 and is further detailed in Drawings C-3 through C-9 (paragraph 6.1.3).

The work includes clearing, filling and compaction of areas being prepared for:

(1) Ready room addition and the adjacent parking area.

(2) The trailer parking area near the complex entrance.

(3) Construction of decontamination building and waste water holding area.

(4) Construction of spacecraft access road and unloading apron.

(5) Construction of holding pond.

(6) Construction of fuel holding area, including fuel delivery access road, revetted fuel storage structure and vapor disposal unit pad.

(7) Construction of oxidizer holding area, including oxidizer delivery access paving, revetted oxidizer storage structure and vapor disposal unit pad.

(8) Construction of air-conditioning shed.

Grades, layout, degree of compaction and materials of construction are established in reference drawings or applicable specifications.

Fence relocation, removal of excess facilities and treatment of their areas, disposition of abandoned facilities, reconditioning of paving and civil structures, and revisions to the complex storm drainage system are covered in reference drawings and specifications.

6.3 LAUNCH COMPLEX FACILITY MODIFICATIONS

6.3.1 Launch Deck

Adaptation of the Titan I complex for Gemini operations necessitates modifications to the vehicle handling equipment and the propellant and pneumatic systems. These modifications establish a basis for facility modifications at the launch deck.

Location of this work on the launch complex is outlined in the following drawings.

Drawing No.	Title
S-1	General Arrangement, Launch Deck Plan
S-2	General Arrangement, Launch Deck Sections
S-18	Launch Deck, Depression for White Room
S-19	Launch Deck, Additional Air-Conditioning Shed
M-23	Air-Conditioning Shed Plan--Detail
M-24	Air-Conditioning Shed Detail--Schedules
E-13	Air-Conditioning Shed for Spacecraft Enclosure--Air-Conditioning Equipment
S-20	Launch Deck Elevator Ramp and Mount
S-21	Launch Deck, North Ramp Extension, Framing Plan and Details
S-22	Launch Deck, North Ramp Extension, Footing Plan and Sections
S-24	Launch Deck, Propellant and Nitrogen Shelter Plans
S-25	Launch Deck, Propellant and Nitrogen Shelter Sections and Details
S-26	Launch Deck, Complete Vehicle Erector (CVE), Actuator Covers and Seals
S-27	Launch Deck, Second-Stage Erector (SSE) Actuator Covers and Seals

Launch deck depression (S-18). This provides a recess in the concrete portion of the existing deck for the complete vehicle erector (CVE) white room when the CVE is in the down position. The work includes removal of a section of concrete deck and its replacement as a recessed structure to provide required clearances.

Additional air-conditioning shelter (S-19, M-23, M-24 and E-13). This will be constructed adjacent to the existing shelter (location shown on C-3) to provide space for installation of the white room air-conditioning equipment. It is a steel frame shed, having a corrugated cement-asbestos roof, constructed on a concrete slab foundation. An adjacent concrete slab contains concrete pads upon which refrigerant condensers are installed. Air-conditioning equipment and electrical power are provided.

North ramp extension (S-21 and S-22). This provides a platform where the spacecraft can be placed prior to its being hoisted for assembly to the launch vehicle in the white room. It also provides additional work area at launch deck level adjacent to both the complete vehicle launch position and the second-stage test position. Below deck level, the structural framing of the deck provides supporting members for piping in the area. The extension is of structural steel supported on reinforced concrete pier footings having the structural deck steel tied into the existing launch deck steel. Decking is steel grating except for steel plates at the lift position of the spacecraft. After completion of the ramp extension, the Contractor will install the jib hoist (GFE) on the pad constructed as part of the extension.

Propellant and nitrogen shelter (S-24 and S-25). This shelter, on the east side of the stands, provides a covered deck at the 16.7-foot elevation where the fuel and oxidizer distribution units and the nitrogen control unit are installed.

The shelter is steel frame tied into existing steel structure where possible, and supported otherwise by columns placed on reinforced concrete pier footings. The deck is reinforced concrete slab construction, and the shed-type roof is corrugated cement-asbestos. Stairs from grade to the deck (16.7-foot elevation) and from this elevation to the deck (28-foot elevation) are structural steel. The deck is compartmented by concrete curbs, graded and drained to confine spills and drainage to a limited area.

Erector actuator covers and seals, CVE and SSE (S-26 and S-27). These are provided on the launch deck to seal the actuator pits from the entry of propellants in case of spills and to reduce loss of pressurizing media from the pit. The work is identical to the sealing work accomplished on pads converted for Titan II operations. The work includes fabrication of rolling covers with sealing boots which surround the actuator arms. Seals are provided in the boots, on the covers and on the actuator arms to effect the sealing function. The covers are actuated by movement of the arms and are provided with bearing rollers running on plate track welded to the grating deck. The space between the tracks for the length of movement of the covers is concrete-filled. Sealing materials are butyl rubber and teflon.

Elevator ramp and operating equipment mount (S-20). This mount is erected on the east side of the launch deck adjacent to the CVE to provide access to the new erector elevator (GFE) at its lower stop position. Below the launch deck position of the ramp, an elevator operating equipment platform is hung from existing launch deck support steel. This platform carries the elevator cable drum and the drive equipment. Access to the ramp is from the launch deck and to the platform by ladder from the 11-foot elevation in the actuator pit. The ramp and platform are structural steel with grating decking. Pipe handrails are provided for personnel safety.

6.3.2 Complete Vehicle Erector (CVE), Lower Structure

Structural modifications to the CVE are required to meet Gemini design parameters established for the erector. The addition of the white room and other appurtenances to the CVE, along with the requirement that it be modified below the white room to meet the Titan II vehicle configuration, imposes increased structural demands during its use.

The structural strengthening and Titan II modification conformance work is detailed in the following drawings.

Drawing No.	Title
S-9	Tower Framing Elevations and Schedules
S-10	Tower Sections and Details
S-11	Tower Sections and Details
S-12	Tower Platforms, Ladder and Miscellaneous Details

Modifications for Titan II. Modifications to meet the Titan II launch vehicle configuration (S-9) require relocation of a platform from a CVE elevation of 26 feet 7 inches to 35 feet 4-3/16 inches (an existing structural level) and removing 1 foot 10 inches from the main columns and splicing just below the existing 72-foot 1-inch platform level to establish this platform at the 70-foot 3-inch erector elevation. The latter work results in lowering the next platform above to its desired 80-foot 8-inch erector elevation. Above this elevation, structural members are added to carry the white room structure.

Structural strengthening. Strengthening the structure (S-9 through S-11) includes the addition of plates at the column splices; removal and replacement of diagonal members; and adding additional members to existing diagonals, columns and struts. Material to accomplish this work is being supplied as GFE.

Miscellaneous modifications (S-12). These include an extension to the platform at 80 feet 8 inches to permit erection of an access ladder from that level to an elevation of 91 feet 2 inches (the first platform level in the white room) and the addition of structural supporting members which permit installation of the new GFE elevator.

Installation of the new elevator (GFE) is completed when modifications to the CVE are completed.

6.3.3 Complete Vehicle Erector, White Room

Of major importance in providing operational facilities at the complex is the addition of the white room to the CVE. Since the spacecraft must be maintained in a clean, environmentally controlled atmosphere during its preflight checkout and flight readiness tests, the CVE must be fitted to provide this facility capability. In addition to serving this function, the CVE must provide the means for positioning the various stages of the vehicle so that they can be erected for assembly. Also, the CVE must provide a means of entrance to and exit from the vehicle work areas.

Integration of these functions into a working unit is detailed in the following drawings.

Drawing No.	Title
S-3	White Room, South and East Elevations
S-3A	White Room, North and West Elevations
S-4	White Room, South and East Framing
S-4A	White Room, North and West Framing
S-5	White Room, Floor and Roof Plans
S-6	White Room, Floor and Roof Framings--Platform Diagrams
S-7	White Room Roof Framing Plan and Door Operating Equipment

Drawing No.	Title
S-7A	White Room Bascule Door Framing, Hardware and Mechanism Details
S-8	White Room Connection Details
S-8A	White Room Connection Details
S-8B	White Room Connection Details
S-8C	White Room Stairs and Ladder
S-8D	White Room Miscellaneous Details
M-16	Complete Vehicle Erector, Piping Details
M-25	Spacecraft Environmental Enclosure--Plans
M-26	Spacecraft Environmental Enclosure--Elevations
E-21	Complete Vehicle Erector Platforms
E-22	Spacecraft Environmental Enclosure Platforms

White room. The white room (all referenced drawings) is constructed as an extension to the upper section of the erector above the 91-foot 2-inch CVE elevation. It provides a complete enclosure around the spacecraft so that its environment can be controlled.

The structure is aluminum throughout to minimize weight. Structural and bent aluminum shapes are used in fabricating framing and the closure envelope. The envelope walls are double wall sheet aluminum having Z-sections and channel stiffeners. The north wall of the white room is provided with a rolling door over its full height which serves as a closure when interior environmental control is being maintained.

The working areas within this space include five fixed platform levels of which three have folding platforms (AGE) to provide working areas surrounding the spacecraft. The upper two fixed platform levels are termed diaphragms to distinguish them from normal working platforms; however, their purpose is equally divided between functional use as working levels and structural use in providing rigidity to framing. The lowest fixed platform and its folding segments (AGE) are equipped with seals to reduce loss of conditioned air from the white room.

A hinged roof, which is power actuated for opening when the erector is down, is provided to permit entry of the launch vehicle trailer prior to off-loading the stage to its erector support system. The operating mechanism includes a power-driven cable drum shaft and cable used to raise the roof in a manner similar to the action of a bascule bridge.

A 5-ton hoist on a traveling bridge (GFE) is mounted under the roof support structure. The hoist is designed to position the vehicle stages on their respective interfaces or on the thrust mount. It is also used to raise the spacecraft from the north ramp extension of the launch deck to its position in the white room. The crane beams extend beyond the north face of the erector to permit positioning of the hoist above the spacecraft pickup point. The crane beams are constructed with a hinged section in the plane of the north face of the erector to permit closure of the rolling door whenever it is desired to provide environmental control in the white room.

Access to the white room is gained by an existing elevator on the west side, a new elevator (GFE) on the east side, or by ladder from the next lower fixed platform. Within the space the primary work platform levels are interconnected by stairs. Above the CVE elevation of 109 feet 1 inch, access is provided by ladder only. Structural supports for the new elevator are provided. The existing elevator serves platforms up to CVE elevations of 91 feet 2 inches. The new elevator serves only three platforms in the white room (i.e., 91-2, 100-2 and 109 feet 2 inches).

Removable launch vehicle trailer rails are provided within the white room area to permit a full folding platform closure at each working platform level and to effect a weight saving in the erector structure.

Hose bibs, safety showers and eyewash fountains (M-16) are provided at the three working platform levels in the white room.

Air-conditioning ducts (M-25 and M-26) distribute conditioned air to four levels in the white room. The supply connection is at the 91-foot 2-inch CVE elevation, where flexible ducting from the umbilical tower connects to rigid ducting located on the CVE. Duct runs on the CVE are installed along the exterior west wall with runouts to various level supply outlets.

6.3.4 Second-Stage Erector (SSE)

Modifications to the SSE are minor and involve the relocation of the elevator machinery and provisions for its operation. Hose bibs, emergency safety showers and operational lighting are provided.

Details of these items appear in the following drawings:

Drawing No.	Title
G-23	Second-Stage Erector (SSE), Second-Stage Umbilical Tower Platforms
M-17	Second-Stage Erector, Piping Plan Details
S-23	Launch Deck-Erector Second-Stage Modification.

The elevator machinery is relocated from the 20-foot 5/16-inch elevation to an elevation of 8 feet 5-5/16 inches above the hinges to provide required access clearances. A slot is cut in the platform at the 20-foot 5/16-inch elevation for elevator cables. A section of the grating platform at the elevation of 8 feet 5-5/16 inches is removed for clearance.

Domestic water supply piping is provided to hose valves at the four platform elevations, and to a portable emergency shower and an eye-wash fountain at the 8-foot 5-5/16-inch elevation.

Operational lighting and utility outlets are provided at each erector platform level.

6.3.5 Second-Stage Umbilical Tower (SSUT)

Modifications to the SSUT are minor in that it is necessary to relocate one platform only from the 13-foot 8-inch CVE elevation to the 7-foot 8-inch CVE elevation and add an extension to a platform at the 32-foot 8-inch CVE elevation.

Details of this work appear in the following drawings.

Drawing No.	Title
S-12	Tower Platforms, Ladder and Miscellaneous Details
S-28	Second-Stage Umbilical Tower, Plans and Elevations, Sections and Details
E-23	Second-Stage Erector Platforms, Second-Stage Umbilical Tower Platforms

The relocated platform and extension (S-12 and S-28) are fabricated of structural steel and have grating decks. Personnel safety is effected by the installation of a piping handrail.

New ladder cage bars are added where one platform has been removed and a bar is removed at the new platform location. Second-stage umbilical tower lighting (E-23) is provided to meet program requirements.

6.3.6 Decontamination Building

Toxicity of the propellants used in the Gemini launch vehicle requires that personnel engaged in propellant transfer and fueling operations wear protective clothing, including self-contained breathing equipment.

A decontamination building has been provided in the complex area to provide a segregated space where protective clothing, self-contained atmospheric pressurization ensemble (SCAPE), can be donned or removed, where breathing apparatus can be serviced, and where contaminants can be cleansed from this equipment before personnel exposure.

The location and details of construction of this facility are contained in the following drawings.

Drawing No.	Title
C-3	Layout Plan
S-29	Decontamination Building Plans, Sections and Details
S-30	Decontamination Building
M-21	Decontamination Building--Air-Conditioning, Ventilation, Plans, Details, Schedules
M-22	Decontamination Building--Plumbing Plan Details
E-16	Decontamination Building

The building layout provides a locker-dressing room where clean SCAPE suits are donned and stored; a decontamination shower, drain and sensor area; a soiled clothing area where used SCAPE suits are retained; an air pack refilling room; attendant and first aid rooms; and toilet facilities and mechanical equipment room. The flow of returning personnel is controlled to ensure removal of all toxic materials before re-entry into the dressing room and other "clean" areas. The building is heated and air conditioned and decontamination areas are ventilated.

The building is of masonry construction, reinforced where structurally required. Interior columns and the ridge beam are steel. The concrete roof deck is finished with a built-up roof. Floors, except in the shower, toilet and decontamination area, are concrete. Wainscot in the shower, toilet, first-aid and decontamination areas are glazed cement.

6.3.7 Ready Room

Lack of sufficient space for NASA and McDonnell personnel in the existing ready building requires an extension to this facility. The purpose of the extension is to provide spacecraft office areas and space for spacecraft parts and tool storage.

The addition is detailed in the following drawings.

Drawing No.	Title
S-32	Ready Room Extensions, Floor Plans, Elevations and Details
S-33	Ready Room Extensions--Foundation, Roof Plans and Details
M-20	Ready Building Addition, Air-Conditioning and Plumbing Plan
E-15	Ready Building Addition

The building layout provides an area devoted to office space adjacent to the storage area, all constructed on a concrete slab at grade. Interior and exterior walls and the roof are framed with wood. Exterior walls are sheathed with corrugated cement asbestos and the interiors are sheathed with gypsum board. A wood plank roof is covered with insulated built-up roofing. Insulating acoustical tile ceilings are used. The entire addition is air conditioned.

6.3.8 Propellant Holding Areas

Propellants used in the launch vehicle are identical to those required by Titan II. The fuel and oxidizer are stored in specially prepared facilities adjacent to the pad perimeter road. These facilities are similar in construction and are located a sufficient distance from each other, the pad and other facilities, to prevent an incident which might occur at one location from affecting other facilities.

Each facility is constructed with a tank truck unloading position, control shed and propellant storage tank. Necessary piping and electrical services are provided. Each facility is provided with a vapor disposal area nearby.

6.3.8.1 Fuel Holding Area

Location and construction details of this facility are contained in the following drawings.

Drawing No.	Title
C-3	Layout Plan
S-34	Fuel Holding Area Plans and Sections
S-36	Fuel and Oxidizer Holding Areas Sections and Details
S-37	Fuel and Oxidizer Holding Areas Sections and Details
M-3	Plot Plan
M-4	Fuel Holding Area--Plan and Sections
E-9	Grounding Plans and Details--Fuel and Oxidizer Holding Areas
E-10	Fuel Holding Areas
E-12	Details--Propellant Holding Areas
	Fuel Vapor Disposal Unit (Vent Stack)

The three functional areas within this facility are constructed behind a revetment wall protecting them in a direct line of sight from the launch pad. The holding tank (AGE) is contained within an above grade, reinforced concrete, walled pit of which one wall is the revetment-earth-retaining wall. The opposite wall separates the tank from a structural steel shed having a concrete roof which houses the control equipment. Beyond the shed is the truck unloading apron. Each area of the facility is constructed on a concrete slab which is pitched to a drain trench where spills and storm water can be collected. A sump containing a pump provides a collecting point from which liquids can be pumped for disposal. The entire facility is afforded fire protection by a remotely controlled water spray system which can effectively blanket the facility. A personnel safety shower and eyewash facility is provided also.

Piping to the facility includes the fuel and fuel vapor lines, water supply and nitrogen system for fuel transfer.

6.3.8.2 Oxidizer Holding Area

Location and construction details of this facility are contained in the following drawings.

Drawing No.	Title
C-3	Layout Plan
S-35	Oxidizer Holding Area Plans and Sections
S-36	Fuel and Oxidizer Holding Area Sections and Details
S-37	Fuel and Oxidizer Holding Area Sections and Details
M-3	Plot Plan
M-5	Oxidizer Holding Area--Plan and Sections
E-9	Grounding Plans and Details--Fuel and Oxidizer Holding Area
E-11	Oxidizer Holding Area
E-12	Details--Propellant Holding Areas
	Oxidizer Vapor Disposal Unit (Vent Stack)

The three functional areas within the oxidizer holding area are constructed behind a revetment wall which protects them in a direct line of sight from the launch pad. The holding tank (AGE) is contained within an above grade reinforced concrete-walled pit of which one wall is the revetment-earth-retaining wall. The opposite wall separates the tank area from a structural steel shed having a concrete roof which houses the control equipment. The latter wall is not the full height of the shed since the oxidizer does not represent a fire hazard to the remaining areas. Beyond the shed is the truck unloading apron. Each area of the facility is constructed on a concrete slab which is pitched to a drain trench to confine liquid spills and storm water to a collecting system. A sump containing a pump provides a collecting point from which neutralized liquids can be pumped for disposal.

The far end of the tank truck unloading position is equipped with a hoist beam to permit installation of a hoist which is used in placing drums of oxidizer neutralizing agent on a reinforced concrete platform constructed beyond the unloading position. A personnel safety shower and eyewash fountain are provided.

Piping to this facility includes the oxidizer and oxidizer vapor lines, water supply, and nitrogen system for oxidizer transfer.

6.3.9 Complete Vehicle Umbilical Tower (CVUT)

Modifications to the CVUT for Gemini provide for the construction of three additional service platforms and the extension of the tower to support the spacecraft umbilical boom (AGE). These modifications permit continued use of the existing Titan I tower with minimum rework.

Details of this work appear in the following drawings.

Drawing No.	Title
S-38	Complete Vehicle Umbilical Tower--Elevation and Plans
S-39	Complete Vehicle Umbilical Tower--Sections and Details
S-40	Complete Vehicle Umbilical Tower--Sections and Details
E-24	Complete Vehicle Umbilical Tower Platforms

New platforms of structural steel having grating decks and safety handrails are constructed at 37-10, 48-7-3/4 and 93-foot 2-1/4-inch CVUT elevations. A service ladder extension is provided from the 84-foot 8-inch CVUT elevation to the new platform at an elevation of 93 feet 2-1/4 inches.

The CVUT is extended to an elevation of 101 feet 9 inches to provide support for an additional umbilical boom (AGE). This section is constructed of structural steel and extends from the 93-foot 2-1/4-inch elevation.

6.3.10 Approach Ramp Building

Structural modifications to the approach ramp building are of a minor nature being provided primarily to seal the interior of the building from entry of toxic fumes. Considerable electrical modification will be accomplished to adapt the complex to the Gemini program.

Information for these modifications is contained in the following drawings.

Drawing No.	Title
S-41	Approach Ramp Building Modifications
E-17	Approach Ramp Building--First Floor Plan
E-18	Approach Ramp Building--Second Floor Plan
E-19	Approach Ramp Building--Launch Deck Plan
E-20	Approach Ramp Building--Diagrams and Details

The partial walls which close off the former road between Column Lines F and G under the approach building are completed to the underside of the launch deck to establish a full closure. All sleeve penetrations of walls and launch deck are sealed. Ventilation ducts are modified to discharge air externally, and relief dampers are installed in the actuator pit walls where a positive ventilation pressure is to be maintained.

New circuit breakers, a conduit wiring system and other electrical gear are installed in accordance with Drawings E-17 through E-20.

6.3.11 Blockhouse

The Gemini program imposes no major change in blockhouse requirements. Personnel safety requirements require that more suitable provisions be made for use of the escape ladder; lack of ventilation within first floor enclosures requires that improvements be made to provide air-conditioned ventilating air to these areas.

Information for these changes is contained in the following drawings.

Drawing No.	Title
S-42	Blockhouse Escape Ladder Relocation
M-19	Blockhouse Air Conditioning, First Floor
E-14	Blockhouse Floor Plans

The escape ladder to the air intake pit formerly was a safety hazard in that no platform was provided at the top of the ladder. Relocation of the ladder and installation of a grating platform upon which the access door opens provides a more satisfactory means of egress.

The first floor area originally depended on its function as a return air plenum for ventilation. Partitions within the area prevent adequate circulation of air. Utilization of existing air-conditioning units and the addition of supply ducts to these inadequately treated areas fulfill ventilation requirements.

6.3.12 Utilities

General utilities modifications for Gemini are dictated by launch vehicle and spacecraft requirements. The interrelation of these modifications are better depicted on overall mechanical and electrical drawings (system installation drawings accompanied by schematic diagrams, schedules, legends and miscellaneous installation details). General utilities modifications are shown in detail in the following drawings.

Drawing No.	Title
M-6	Compressor Building Nitrogen Piping--Legend 5, Symbols, Schedules and Valve Designations
M-7	Launch Deck and Propellant Distribution Area Piping Plan
M-8	Launch Deck Piping Plan Below the 27-Foot Elevation
M-9	Launch Deck Piping Plan Below the 14-Foot Elevation
M-10	Launch Deck Piping Elevations
M-11	Launch Deck Piping Sections

Drawing No.	Title
M-12	Transfer Piping Details and Piping Supports
M-13	Skimming Basin--Plan and Details
M-14	Skimming Basin--Neutralizing Facilities
M-15	Complete Vehicle Erector Piping Plans
M-18	Valve Schedules
E-1	Symbol Legend, General Notes, Receptacle Details and Abbreviations
E-2	Power Distribution, Lighting--Site Plan
E-3	Power Distribution System--Details
E-4	Power Distribution System--Details
E-5	Communications, TV Camera--Site Plan
E-6	Grounding--Site Plan
E-7	Power Distribution System--Typical Connection Diagram
E-8	Grounding Diagrams--Power Distribution System
E-25	CVE, CVUT, SSE, SSUT Riser Diagrams
E-26	Skimming Basin Neutralizer
E-27	Deluge System
E-28	Deluge System Controls
E-29	Light Fixture Details
E-30	Schedules--Panels, Switches, Breakers and Starters

The mechanical drawings (M) primarily cover the installation of pipings systems for fluids and gases and their methods of support where modifications to the existing Titan I installations are required. Process water (cooling and fire fighting) and domestic water (equipment cleaning, sanitation, personnel safety and other miscellaneous uses) installation details are provided as are distribution details of propellant piping and pneumatic systems. Neutralization equipment and related piping for the skimming basin fluid treatment system are also detailed.

Modifications to the electrical supply and distribution system of the complex are limited to facilities within the area. Main feeders to the complex are adequate. Electrical drawings (E) provide the installation details for the power and light distribution systems, the communications and camera systems and the various facility remote control systems. Within specific facilities, the internal electrical systems are detailed in the respective facility electrical drawings.

7.0 DESCRIPTION OF AGE SUBSYSTEMS INSTALLATION AND CHECKOUT

This section presents descriptions of the installation of the complete air vehicle AGE subsystems and the checkout of the launch vehicle subsystems performed by Martin acting as integrating contractor.

The sequence of the events for each of the various sections is considered the optimum sequence for the effort involved. However, it is not the intent of this document to restrict the operations of the installation subcontractor if unforeseen events make a rearrangement of the sequence of operations desirable.

The degree of detail provided permits the document user to monitor the installation of all functional end items of a given system, and to assure himself that no major component has been omitted.* This documentation listing provided enables the document user to obtain more detailed information to the level desired.

Updating and expansion of the spacecraft sections will be accomplished as information becomes available.

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*It is not the intent in this document to define the installation of non-functional items and of attaching hardware. The referenced documentation will provide this information if is desired.

7.1 TUNNEL, UMBILICAL, MARRIAGE AND ERECTOR CABLING INSTALLATION

7.1.1 Description

The cable set (CP 9501) contains the following cabling for interconnecting junction points which serve many subsystems and test sets:

(1) Tunnel cabling. The existing Titan I cabling (CP 4600) in the tunnel and a small amount of additional cabling for interconnecting the terminal boards in the blockhouse terminal area and the approach ramp transfer room (Fig. 7-1).

(2) Transfer room cabling. Interconnections between patch panel PP2A and the distribution racks servicing the umbilical junction boxes (Fig. 7-2).

(3) Launch vehicle marriage cabling. Interconnections between Stage I and Stage II. These are used during the sequential compatibility firing (Fig. 7-3).

(4) Umbilical cabling. Interconnections between the transfer room junction points and the umbilical junction boxes on both the complete tower and the Stage II tower (Fig. 7-4). This cabling includes the launch vehicle umbilical connectors.

(5) Launch vehicle erector and erector control cabling. Interconnections between MOCS, motor controller, hydraulic power supply, distribution racks and erector junction boxes (Figs. 7-5 and 7-6).

7.1.2 Sequence of Events

7.1.2.1 Rack Assembly TBC4 Installation

7.1.2.1.1 Install rack assembly TBC4 (Part No. 424-9501390-009) in the transfer room at Location 210 (Fig. 7-1). This rack shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.1.2.2 Rack Assembly DRL1 Installation

7.1.2.2.1 Install rack assembly DRL1 (Part No. 424-9501380-009) in the transfer room at Location 201 (Fig. 7-4). This rack shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.1.2.3 Rack Assembly DRC1 Installation

7.1.2.3.1 Install rack assembly DRC1 (Part No. 424-9501380-019) in the transfer room at Location 203 (Fig. 7-4). This rack shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.1.2.4 Rack Assembly DRC3 Installation

7.1.2.4.1 Install rack assembly DRC3 (Part No. 424-9501380-185) in the transfer room at Location 110 (Fig. 7-4). This rack shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.1.2.5 Junction Box CUB1 Installation

7.1.2.5.1 Install junction box CUB1 (Part No. 424-9501420) on the complete umbilical tower (Fig. 7-4). This box shall be located and installed in accordance with Drawing 424-2054500, Junction Box Installations.

7.1.2.6 Junction Boxes CUB2 and CUB3 Installation

7.1.2.6.1 Install junction boxes CUB2 and CUB3 (Part No. 424-9501430) on the complete umbilical tower (Fig. 7-4). This box shall be located and installed in accordance with Drawing 424-2054500, Junction Box Installations. (NOTE: This junction box is installed on the umbilical towers in two places.)

7.1.2.7 Junction Box CUB4 Installation

7.1.2.7.1 Install junction box CUB4 (Part No. 424-9501440) on the complete umbilical tower (Fig. 7-4). This box shall be located and installed in accordance with Drawing 424-2054500, Junction Box Installations.

7.1.2.8 Junction Box 2UB5 Installation

7.1.2.8.1 Install junction box 2UB5 (Part No. 424-9501430) on the Stage II Test umbilical tower (Fig. 7-4). This box shall be located and installed in accordance with Drawing 424-2154500, Junction Box Installations.

7.1.2.9 Junction Box 2UB6 Installation

7.1.2.9.1 Install junction box 2UB6 (Part No. 424-9501440) in the Stage II test umbilical tower (Fig. 7-4). This box shall be located and installed in accordance with Drawing 424-2154500, Junction Box Installations.

7.1.2.10 Tunnel Cabling Utilization and Installation

7.1.2.10.1 Utilize and install (where required) tunnel cabling in accordance with Drawing 424-9501250, Tunnel Wiring Cabling Set, and Drawing 424-2050300, Cable Set Installation, AGE. Interconnections are provided between points as shown in Fig. 7-1.

7.1.2.11 Transfer Room Cabling Installation

7.1.2.11.1 Install the transfer room cabling in accordance with Drawing 424-9501310, Transfer Room Cabling Set, and Drawing 424-2050300, Cabling Set Installation, AGE. Interconnections are provided between units in the transfer room as shown in Fig. 7-2.

7.1.2.12 Umbilical Tower Cabling Installation

7.1.2.12.1 Install the umbilical cabling in accordance with Drawing 424-9501460, Umbilical Wiring Cable Set, and Drawing 424-2050300, Cable Set Installation, AGE. Interconnections are provided between units as shown in Fig. 7-4.

7.1.2.13 Marriage Cables Installation

7.1.2.13.1 Install marriage cables in accordance with Drawing 424-9501470, Launch Vehicle Marriage Cable Set, and Drawing 424-2050300, Cable Set Installation, AGE. Interconnections are provided between items as shown in Fig. 7-3.

7.1.2.14 Erector Cables Installation

7.1.2.14.1 Install erector cables in accordance with Drawing 424-9501484, Launch Vehicle Erector System Cable Set, and Drawing 424-2050300, Cable Set Installation, AGE. Interconnections are provided between items as shown in Fig. 7-6.

7.1.2.15 Erector Control Cables Installation

7.1.2.15.1 Install erector control cables in accordance with Drawing 424-9501480, Launch Vehicle Erector Control System Cable Set, and Drawing 424-2050300, Cable Set Installation, AGE. Interconnections are provided between items as shown in Fig. 7-5.

Connections between terminal boards in the terminal room and the transfer room are provided by the tunnel cabling set.

7.1.3 Checkout Procedure

7.1.3.1 Cable Checkout

The cables are checked out in accordance with 424-9501001, AMR Cable Test Specification, prior to use.

7.1.4 Documentation

Document No.	Title
424-2050300	Cable Set Installation, AGE
424-2054500	Junction Box Installations
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2154500	Junction Box Installations
424-4501420	Junction Box, Umbilical Tower
424-9501001	AMR Cable Test Specification
424-9501250	Tunnel Wiring Cabling Set
424-9501310	Transfer Room Cabling Set
424-9501380	Rack Assembly
424-9501390	Rack Assembly
424-9501430	Junction Box, Umbilical Tower
424-9501440	Junction Box, Umbilical Tower
424-9501460	Umbilical Wiring Cabling Set
424-9501470	Launch Vehicle Marriage Cable Set
424-9501480	Launch Vehicle Erector System Cable Set
424-9501484	Launch Vehicle Erector Control System Cable Set

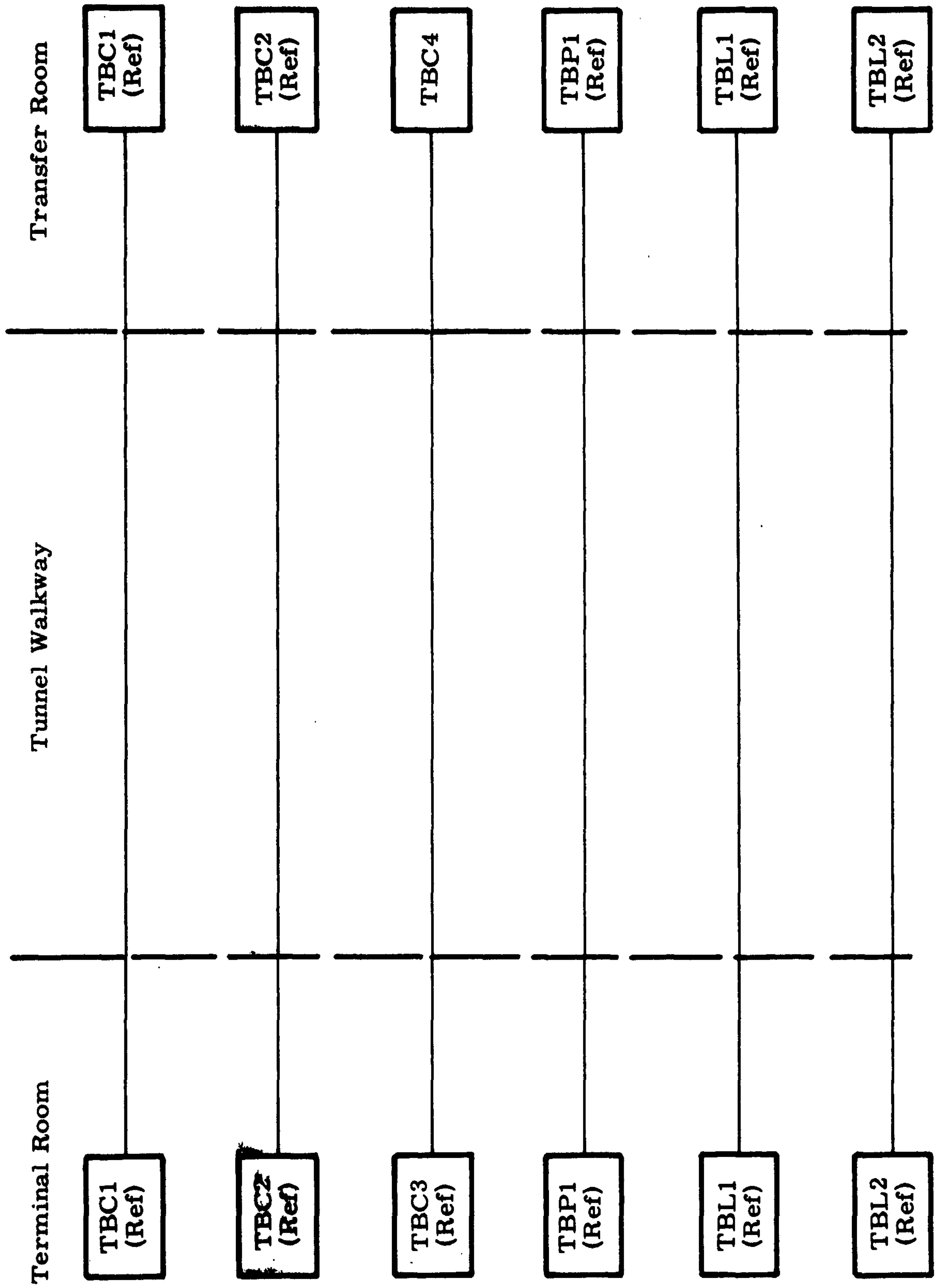


Fig. 7-1. Tunnel Cabling

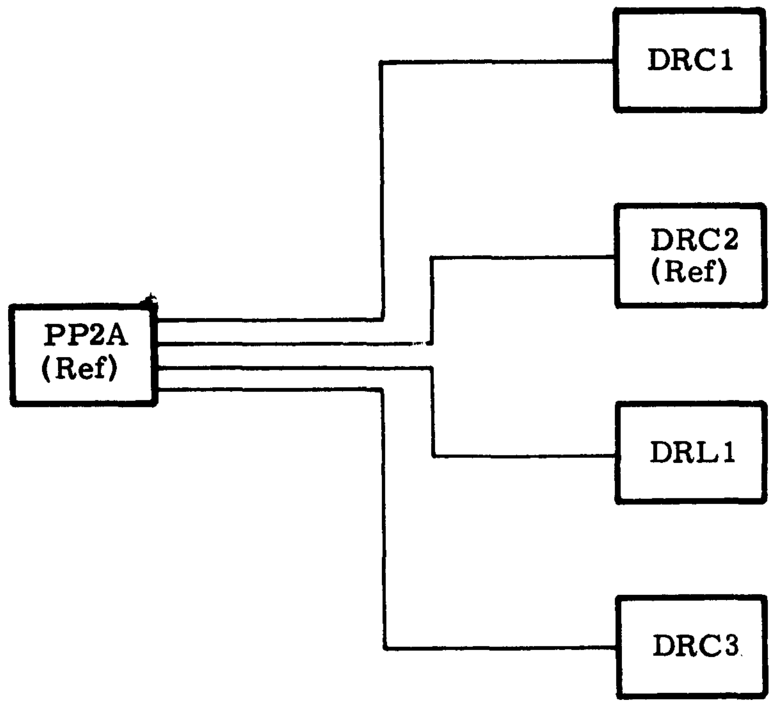
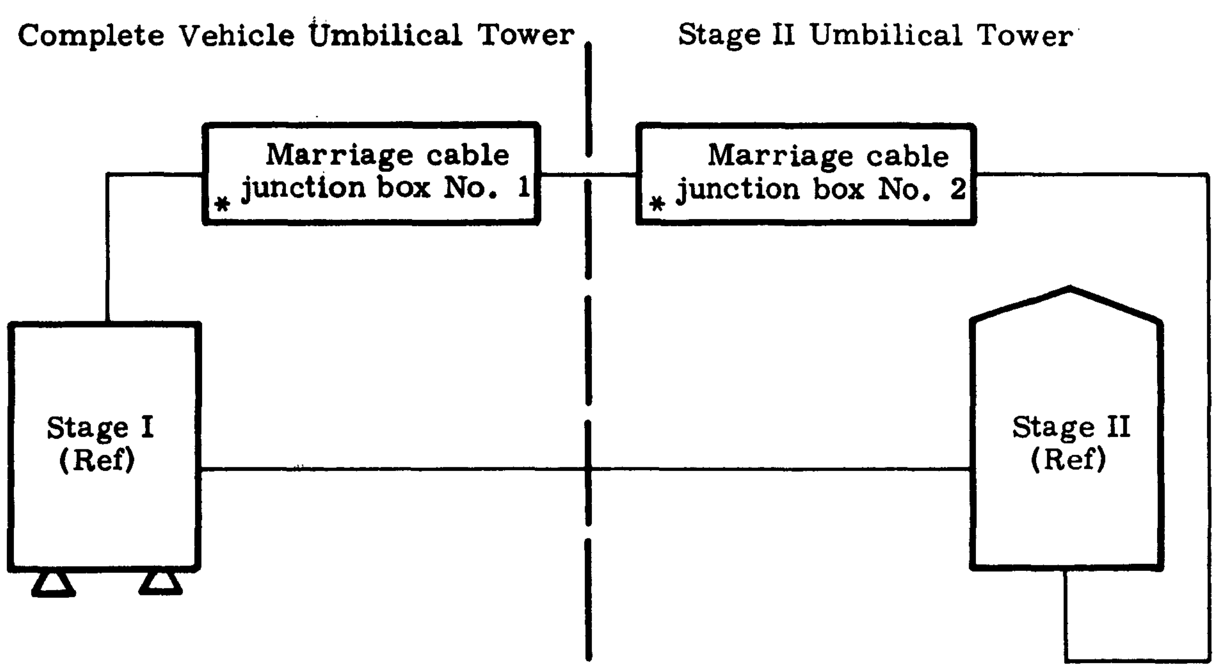
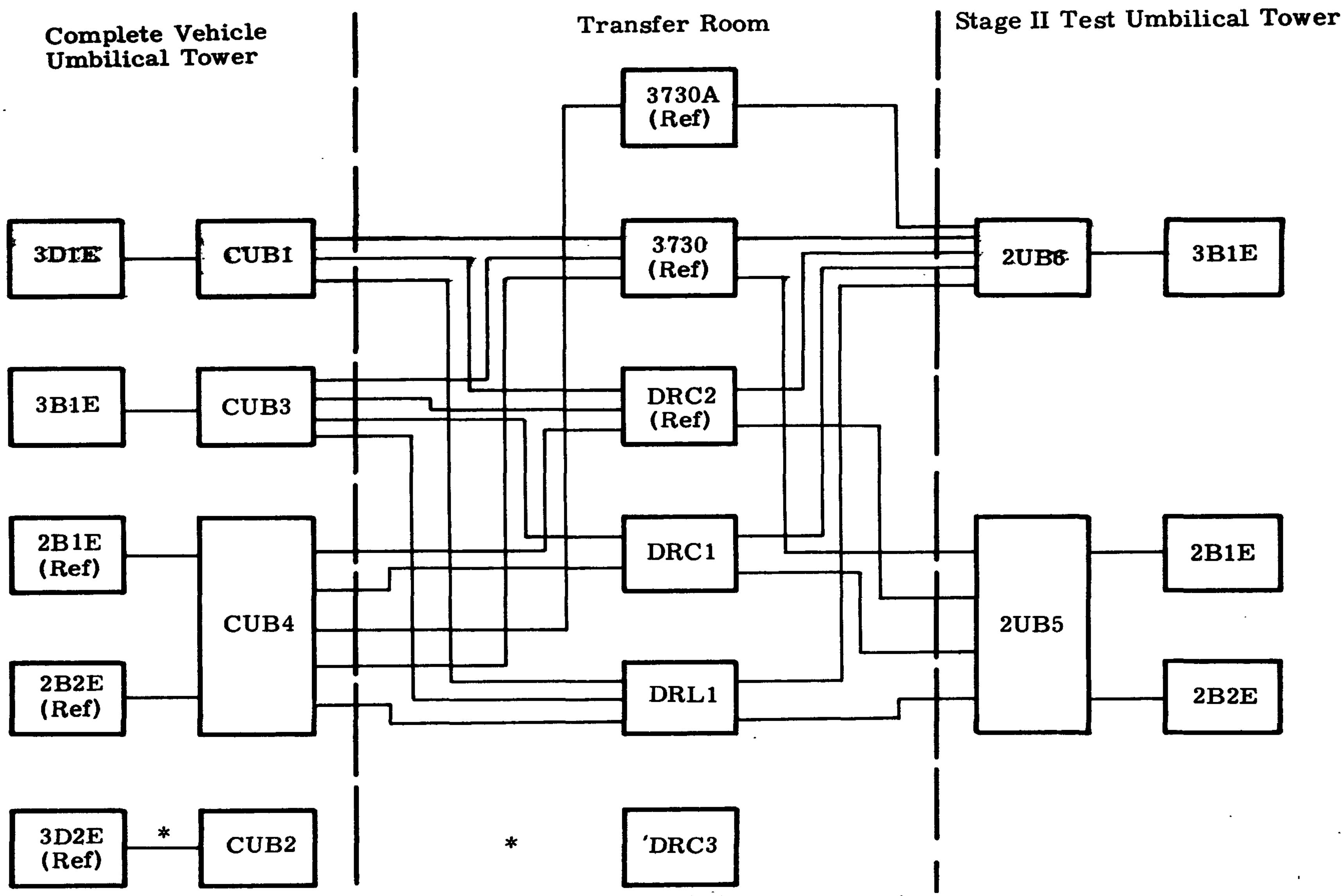


Fig. 7-2. Transfer Room Cabling



*Utilize existing marriage cabling junction boxes.

Fig. 7-3. Marriage Cabling



*Wiring to these units is currently being developed (refer to DCR 17)

Fig. 7-4. Umbilical Cabling

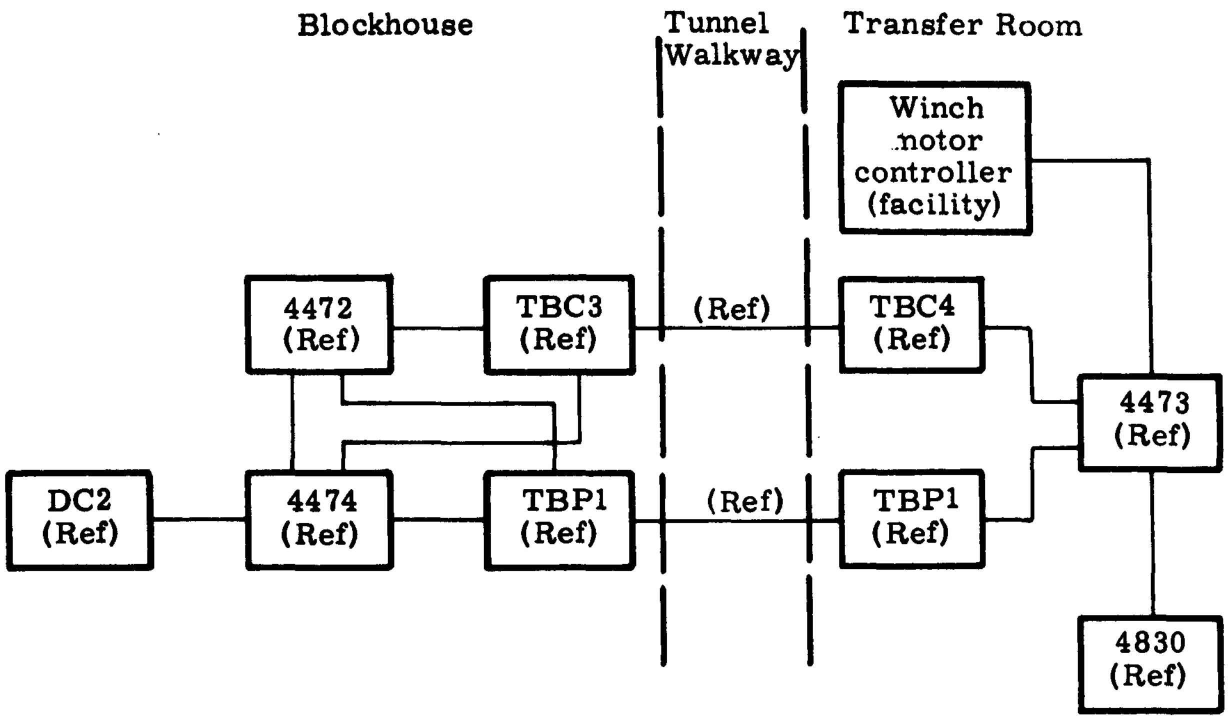


Fig. 7-5. Launch Vehicle Erector System Cabling

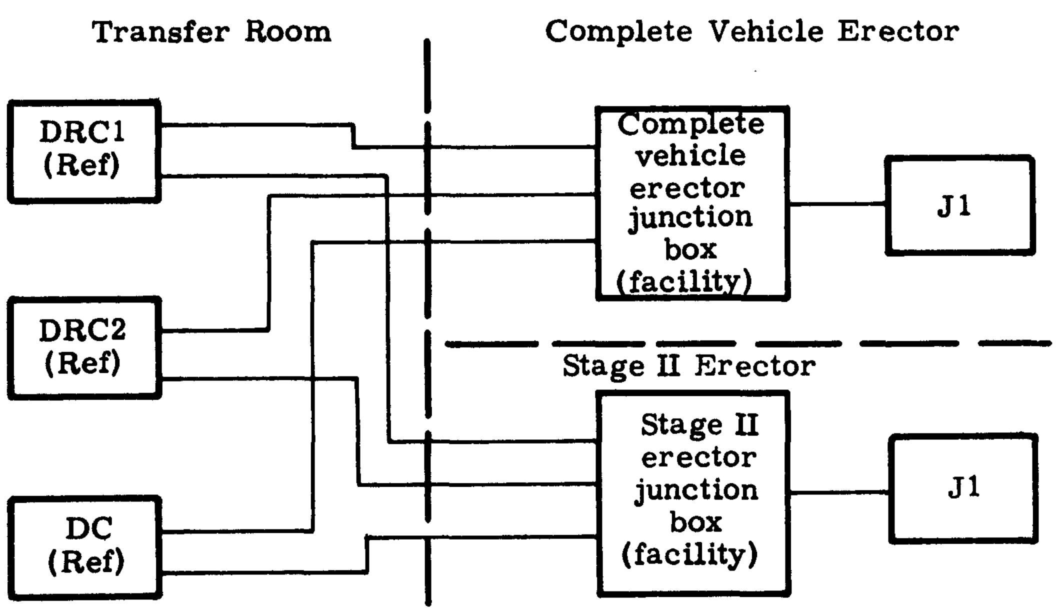


Fig. 7-6. Launch Vehicle Erector System Cabling

7.2 PROPELLANT TRANSFER AND PRESSURIZATION SYSTEM INSTALLATION (CP 9550)

7.2.1 Description

7.2.1.1 System Functional Description

The Propellant Transfer and Pressurization System (PTPS) consists of the fuel and oxidizer transfer systems plus venting and propellant vapor disposal (Fig. 7-7). Generally, the equipment units and piping sizes for the fuel transfer system are identical with those of the oxidizer transfer system. Further, the systems are similar to those of Titan II except for the addition of test position propellant loading, distribution unit flowmeter, holding area, ready storage vessel (20,000-gallon capacity), pumps for concurrent loading of Stages I and II, and a distribution unit pump for propellant unloading.

The PTPS, with central control in the blockhouse and local controls, accomplishes the following functions:

(1) Transfers propellant from tank trailers to the ready storage vessel in readiness for launch vehicle loading.

(2) Through the heat exchanger and circulating units, conditions the propellants to the required temperature.

(3) By holding area pumps, meters and transfers propellants to vehicle stages at test and launch positions.

(4) Off-loads Stages I and II tanks, when required.

(5) Purges vehicle tanks, ground system piping, etc., with gaseous nitrogen.

(6) Maintains a blanket of nitrogen gas within vehicle tanks, storage vessels, piping, etc., at all times whether containing propellants or empty.

(7) Provides a venting of storage vessels and vehicle tanks in normal and emergency modes.

(8) Disposes of toxic fuel and oxidizer vapors in the facility vapor disposal units.

(9) Disposes of post-operation propellant contained in the holding area storage vessel by transfer to tank trailers for removal to the CCMTA tank farm.

7.2.1.2 Component Description

7.2.1.2.1 Fuel and Oxidizer Holding Areas

The units within the fuel holding area (Fig. 7-8) are the fuel ready storage vessel, heat exchanger and circulating units, temperature control unit, transfer control unit and the motor control center (facility). The area is controlled by the control set in the blockhouse or the local control panel. The vapor disposal unit is located some distance from the fuel transfer area (Figs. 7-13 and 7-14).

The units in the oxidizer holding area (Fig. 7-9) are the same as in the fuel holding area.

The oxidizer and fuel holding areas each contain the six items presented in subsequent paragraphs.

(1) Ready storage vessel. Each transfer system--fuel and oxidizer--utilizes a 20,000-gallon capacity storage tank. This horizontal, cylindrical tank has torespherical bulged heads with no internal support structure. The outside diameter of this stainless steel tank is 9 feet, and externally, it is about 46 feet long. The tank is covered with 4-inch insulation. There are provisions for hoisting the tank, using a 4-point sling. The tank cradles are installed on a sloping concrete floor.

(2) Propellant transfer control unit (CP 1514 and CP 1515). This portable unit containing pressure regulator valves, filters, relief valve, manual valves, etc., performs the following functions:

  (a) Transfers propellant by gas pressure from the tank truck to the ready storage vessel.

  (b) Filters propellant pumped from the holding area.

  (c) Transfers toxic vapors from the pad and holding area to the facility vapor disposal unit.

  (d) Regulates nitrogen gas in the purging and blanketing of the storage vessel, etc., in the holding area.

(3) Temperature control unit (CP 1512). The skid-mounted, portable unit provides automatic cooling or heating as required. The heat transfer medium from the unit is circulated through the heat exchanger.

This unit operates automatically after the controls have been set. The same unit is used for Titan II.

(4) Heat exchanger and circulating units (CP 1593 and CP 1594). An assembly of off-the-shelf equipment maintains the desired propellant temperature in the ready storage vessel. Included are a shell and tube-type heat exchanger, the centrifugal pumps mentioned below, remote operating valves and interface piping. Heat transfer is accomplished by circulating an ethylene glycol-water solution through the heat exchanger, piped from the temperature control unit.

(5) Centrifugal pumps. Two pumps are contained in each heat exchanger and circulating unit for propellant temperature control and vehicle loading. Normally, one pump is used to load the Stage I tank and the other to load the Stage II tank, thus permitting simultaneous loading of both stages by their respective pair of pumps.

During propellant conditioning, either pump may be used to circulate the propellant through the appropriate heat exchanger.

These pumps are bypassed during transfer of propellant to the storage tank from the launch vehicle tanks or from the tank truck.

7.2.1.2.2 Propellant and Nitrogen Distribution Shelter

The equipment within the distribution area includes the oxidizer distribution unit, the fuel distribution unit and the nitrogen controller unit (Fig. 7-15). The motor control center for these units is located in the electrical equipment room, first floor. The equipment is controlled and monitored by the control set in the blockhouse, and no local panel is required.

NOTE:

The nitrogen controller unit and filter banks are part of the Pneumatic System (Section 7.5).

Propellant distribution unit (CP 1591 and CP 1592). These skid-mounted, portable units (oxidizer and fuel) dispatch propellants to either the test or launch positions.

Of the flowmeters in each propellant inlet line, one measures propellant loaded into or off-loaded from the Stage I tank and the other provides the same function for the Stage II tank at either the test or launch position.

A centrifugal pump is a part of the unit. It unloads the Stage I tanks. Stage II tanks are unloaded by tank pressurization and gravity, and drain through the distribution unit.

The distribution unit is the control point for nitrogen purging, blanketing and pressurization of the vehicle propellant tanks. Each unit manifolds oxidizer and fuel vent and purge exhaust lines from the launch and test positions. From this point, vapors are piped to the propellant holding area for disposal.

7.2.1.2.3 AGE Piping

The AGE piping interconnects subsystems and mates with interfaces.

(1) Propellant holding areas piping consists of:

(a) Heat transfer media piping between the temperature control unit and the heat exchanger in the propellant holding area.

(b) Flexible hose from the transfer control unit to the tank trailer unloading station.

(c) Propellant piping between the transfer control unit, the heat exchanger and circulating units, and the ready storage vessel.

(d) Stages I and II propellant piping from the transfer control unit to the holding area facility piping interface.

(2) Propellant and nitrogen distribution shelter piping.

Propellant lines from fuel and oxidizer distribution units to the facility piping support interface.

(3) Launch pad area piping (Figs. 7-11 and 7-12).

(a) Launch pad piping from the distribution units to the test and launch positions.

(b) Test umbilical tower piping.

(c) Launch umbilical tower piping.

7.2.1.2.4 Blanketing, Purging and Vent Systems

A combination of AGE and facility piping connects the propellant holding areas, propellant and nitrogen distribution shelter and launch and test positions on launch deck.

The AGE piping interconnects subsystems and mates with interfaces.

(1) Propellant holding areas piping (Figs. 7-13 and and 7-14). This consists of the following:

(a) Flexible hose from the transfer control unit to the tank trailer unloading station.

(b) Vent piping from the transfer control unit to the holding area facility piping interface.

(2) Propellant and nitrogen distribution shelter piping (Fig. 7-15). This consists of vent lines from distribution units to the piping support facility interface.

(3) Launch pad area piping (Figs. 7-11 and 7-12). This consists of:

(a) Launch pad piping from the distribution units to the test and launch positions.

(b) Test umbilical tower piping.

(c) Launch umbilical tower piping.

7.2.2 Sequence of Events

7.2.2.1 Installation in the Propellant and Nitrogen Distribution Shelter (Figs. 7-10 and 7-15)

7.2.2.1.1 Install the oxidizer distribution unit.

(1) Install the skid-mounted oxidizer distribution unit within the shelter on the floor using locating dimension from the centerline of the test thrust mount on Drawing 424-1592000.

7.2.2.1.2 Install the fuel distribution unit.

(1) Install the skid-mounted fuel distribution unit within the shelter on the floor using locating dimension from the centerline of the test thrust mount on Drawing 424-1591000.

7.2.2.1.3 Install the oxidizer distribution unit shelter piping (8 lines).

(1) Install the identical Stage I (4 inch) and Stage II (3 inch) oxidizer lines from the distribution unit ports to the facility piping interface. The 4-inch end mates with the facility interface. Include each line a hand valve and a 3- and 4-inch size straight pipe (Fig. 7-10).

(2) Install a 3-inch vent line (Fig. 7-15) between the oxidizer distribution unit and the facility interface.

(3) Install the oxidizer fill and drain piping and vent lines from the distribution unit ports to the AGE/AGE interface in the area of the nitrogen controller unit shelter. Starting with the southern-most end port of the distribution unit, these consist of the 2-inch test position fill and drain line, the launch position 3-inch Stage I fill and drain line, the 2-inch Stage II fill and drain line, the 2-inch Stage II vent line and the 3-inch Stage I vent line.

7.2.2.1.4 Install the fuel distribution unit shelter piping (8 lines).

(1) Install the identical Stage I and Stage II fuel lines from the distribution unit ports to the facility piping interface. Include in each line a hand valve and a 3- and 4-inch size straight pipe (Fig. 7-10).

(2) Install a 3-inch vent line between the fuel distribution unit and the facility interface (Fig. 7-15).

(3) Install the fuel fill and drain piping and vent lines from the distribution unit ports to the AGE/AGE interface in the vicinity of the nitrogen controller unit shelter. Starting with the southernmost end port of the distribution unit, these consist of the 2-inch test position fill and drain line, the launch position 3-inch Stage I fill and drain line, the 2-inch Stage II fill and drain line (Fig. 7-10), the 2-inch Stage II vent line and the 3-inch Stage I vent line.

7.2.2.2 Oxidizer Holding Area Installation (Figs. 7-9 and 7-14)

7.2.2.2.1 Install the ready storage vessel in accordance with locating dimensions on Drawing 424-1516000.

7.2.2.2.2 Install the pressure switch, pressure gage, liquidometer, temperature gage, vent and hood, and thermocouple, as per Drawing 424-1516000 and insulation as per Drawing 424-1516013.

7.2.2.2.3 Install the heat exchanger and circulating units adjacent to the ready storage vessel, in accordance with locating dimensions on Drawing 424-1594000.

(1) Install the insulation on the heat exchanger, as per Drawing 424-1594013.

7.2.2.2.4 Install the temperature control unit on the pad provided under the shelter roof.

7.2.2.2.5 Install the transfer control unit on the pad provided for it under the shelter roof.

7.2.2.2.6 Install the oxidizer holding area piping (Figs. 7-9 and 7-14).

(1) Install two 3-inch coolant circulating lines from the temperature control unit through the inter-area connectors to the heat exchanger.

   (a) Weld a 10-inch diameter flange to the piping and bolt it to the inter-area connector after line length, etc., has been determined.

   (b) Install a manually operated valve in each line.

(2) Install the oxidizer fill and drain piping and vent lines from the transfer control unit ports to the AGE/facility interface just inside the shelter. Starting with the southernmost end port of the transfer control unit, these consist of:

   (a) Two short 4-inch lines, including 3 x 4-inch reducers and 3-inch piping (Stage I and Stage II fill and drain lines).

   (b) A short 3-inch line from the transfer control unit purge and blanket port to the facility interface (Fig. 7-14).

   (c) A short 3-inch line, including a tee fitting, 3/8-inch line and purge sampling valve from the transfer control unit vapor disposal port to the facility interface (Fig. 7-14).

(3) Install the oxidizer truck flexible connections (Figs. 7-9 and 7-14).

   (a) Install two 3-inch flexible lines and hand valves, one from the oxidizer transfer port and one from the nitrogen pressurization port, for tank trailer unloading.

(4) Install two 4-inch fill and drain lines from the transfer control unit through inter-area connectors to the heat exchanger and circulating units.

   (a) Install two 3- to 4-inch reducers in each oxidizer line to reduce the 4-inch piping to 3 inches at the transfer control unit, the heat exchanger and the circulating unit.

(b) Weld a 10-inch diameter flange to each pipe and bolt it to the inter-area connector after line length, etc., has been determined.

(c) Install a remote operating valve in each line.

(5) Install the oxidizer ready storage vessel piping (Fig. 7-9) from the ready storage vessel to the heat exchanger and circulating units (refer to Fig. 7-7).

(a) Install two 4-inch lines, including hand valves, from ports on the bottom of the tank to the two oxidizer loading pumps.

(b) Install a 3-inch line, including a hand valve, from the heat exchanger to the return port on the top and at the extreme end of the ready storage vessel.

(c) Install a 3-inch line, including a remote operating valve, from the port on top of and at the other extremity of the ready storage vessel to the heat exchanger and circulating units.

7.2.2.3 Fuel Holding Area Installation (Figs. 7-8 and 7-13)

7.2.2.3.1 Install the ready storage vessel in accordance with locating dimensions from Drawing 424-1517000.

7.2.2.3.2 Install the heat exchanger and circulating units adjacent to the ready storage vessel, according to locating dimensions from Drawing 424-1593000.

(1) Install the insulation on the heat exchanger as per Drawing 424-1593013.

7.2.2.3.3 Install the temperature control unit on the pad provided under the shelter roof.

7.2.2.3.4 Install the transfer control unit on the pad provided for it under the shelter roof.

7.2.2.3.5 Install the pressure switch, pressure gage, liquidometer, temperature gage, vent and hood, and thermocouple, as per Drawing 424-1517000 and insulation as per Drawing 424-1517013.

7.2.2.3.6 Install fuel holding area piping (Figs. 7-8 and 7-13) exactly as for the oxidizer holding area (7.2.2.2.6).

7.2.2.4 Propellant and Nitrogen Distribution Shelter-to-Test Position Launch Deck Piping Installation (Figs. 7-10, 7-11 and 7-15

7.2.2.4.1 Install propellant and vent lines from the propellant and nitrogen distribution shelter to the launch deck area.

(1) Install a 2-inch oxidizer fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the deck boom.

(2) Install a 2-inch fuel fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the deck boom.

(3) Install a 2-inch oxidizer vent line from the appropriate AGE/AGE interface in the distribution shelter to the umbilical tower interface.

(4) Install a 2-inch fuel vent line from the appropriate AGE/AGE interface in the distribution shelter to the umbilical tower interface.

7.2.2.5 Propellant and Nitrogen Distribution Shelter-to-Launch Position Launch Deck Piping Installation (Figs. 7-10, 7-11 7-12 and 7-15)

7.2.2.5.1 Install propellant and vent lines from propellant and nitrogen distribution unit to launch deck area.

(1) Install a 3-inch oxidizer fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the deck boom.

(2) Install a 3-inch fuel fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the deck boom.

(3) Install a 2-inch oxidizer fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the launch umbilical tower interface.

(4) Install a 2-inch fuel fill and drain line from the appropriate AGE/AGE interface in the distribution shelter to the umbilical tower interface.

(5) Install a first-stage 3-inch oxidizer vent line from the appropriate AGE/AGE interface in the distribution shelter to the launch umbilical tower interface.

(6) Install a first-stage 3-inch fuel vent line from the appropriate AGE/AGE interface in the distribution shelter to the launch umbilical tower interface.

(7) From the 2-inch oxidizer vent line installed between the distribution shelter and the test position umbilical tower interface (7.2.2.4.1), install a 2-inch oxidizer vent line to the base of the launch position umbilical tower.

(8) From the 2-inch fuel vent line installed between the distribution shelter and the test position umbilical tower interface (7.2.2.4.1), install a 2-inch fuel vent line to the base of the launch position umbilical tower.

7.2.2.6 Test Position Umbilical Tower Piping Installation (Fig. 7-11)

7.2.2.6.1 Install piping on the TPUT from the AGE/AGE interface in accordance with Drawings 424-9551160, 424-9552160 and 424-9553160.

(1) Install a 2-inch oxidizer vent line from the deck AGE/AGE interface up the tower to the point of attachment of the oxidizer vent flexible lines.

(a) Connect to this line a regulator back pressure reducing valve and a 4-inch vent line to the atmosphere.

(b) At the point of attachment of the oxidizer vent flexible lines install a 2-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnects.

(2) Install a 2-inch fuel vent line from the deck AGE/AGE interface up the tower to the point of attachment of the fuel vent flexible lines.

(a) Connect to this line a regulator back pressure reducing valve and a 4-inch vent line to the atmosphere.

(b) At the point of attachment of the oxidizer vent flexible lines install a 2-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnect fittings.

(3) Install oxidizer line purge jumper.

(a) Install the two male quick disconnect fittings to which the oxidizer vent flexible lines attach and connect by 2-inch and 3/4-inch lines to a 2-inch line.

(b) Install this 2-inch line down the tower to the deck boom and terminate with a male quick disconnect fitting.

(4) Install fuel line purge jumper.

(a) Install the two male quick disconnect fittings to which the fuel vent flexible lines attach and connect by 2-inch and 3/4-inch lines to a 2-inch line.

(b) Install this 2-inch line down the tower to the deck boom and terminate with a male quick disconnect fitting.

7.2.2.7 Deck Boom Piping Installation (Test Position) (Fig. 7-11)

7.2.2.7.1 Install the deck boom piping at the TPUT in accordance with Drawings 424-9551160, 424-9552160 and 424-9553160.

(1) Install oxidizer fill and drain line.

(a) Install the liquid level sensor probe at a Conoseal connection at the deck boom, on the 2-inch line installed by paragraph 7.2.2.4.1(1).

(b) Install the 2-inch flexible line at the end of the 2-inch line (7.2.2.4.1) and terminate with a female quick disconnect at the oxidizer purge line jumper near the deck boom.

(c) Install the two sampling station hand valves and female quick disconnects on the 2-inch line (7.2.2.4.1).

(d) Install the 3/4-inch flexible line and the male quick disconnects between the two hand valves quick disconnects.

(2) Install the fuel fill and drain line.

(a) Install the liquid level sensor probe at a Conoseal connection at the deck boom, on the 2-inch line installed by paragraph 7.2.2.4.1(2).

(b) Install the 2-inch flexible line at the end of the 2-inch line (7.2.2.4.1) and terminate with a female quick disconnect at the fuel purge line jumper near the deck boom.

(c) Install the sampling station hand valves and female quick disconnects on the 2-inch line (7.2.2.4.1).

(d) Install the 1/2-inch flexible line and the male quick disconnect between the two hand valves quick disconnects.

7.2.2.8 Pump Seal Drain Lines Installation (Test Position) (Fig. 7-11)

7.2.2.8.1 Install the pump seal drain lines.

(1) Install oxidizer pump seal drain.

(a) Install a 5/8-inch ID flexible line with a slip-on connection at the vehicle engine section.

(b) Install 5/8-inch tubing from the end of the flexible line to a drain sump on the launch deck.

(2) Install fuel pump seal drain.

(a) Install a 5/8-inch ID flexible line with a slip-on connection at the vehicle engine section.

(b) Install 5/8-inch tubing from the end of the flexible line to a drain sump on the launch deck.

(3) Install thrust chamber pressure sequence valve seal drain.

(a) Install the 5/8-inch ID flexible line and the quick disconnect (female) at the vehicle engine section.

(b) Install 5/8-inch tubing from the end of the flexible line to a drain sump on the launch deck.

7.2.2.9 Launch Position Umbilical Tower Piping Installation (Fig. 7-12)

7.2.2.9.1 Install piping on the LPUT from the AGE/AGE interface in accordance with Drawings 424-9551130, 424-9552130 and 424-9553130.

(1) Install the oxidizer vent system.

(a) Install a 2-inch oxidizer vent line from the deck AGE/AGE interface to the point of attachment of the Stage II oxidizer vent flexible lines in the tower.

(b) From this 2-inch vent line install a regulator back pressure reducing valve and a 4-inch vent to the atmosphere.

(c) At the point of attachment of the Stage II oxidizer vent flexible lines install a 2-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnect fittings.

(d) Install a 3-inch oxidizer vent line from the deck AGE/AGE interface to the point of attachment of the Stage I oxidizer vent flexible lines in the tower.

(e) From this 3-inch vent line install a regulator back pressure reducing valve and a 4-inch vent to the atmosphere.

(f) At the point of attachment of the Stage I oxidizer vent flexible lines install a 3-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnect fittings.

(2) Install the fuel vent system.

(a) Install a 2-inch fuel vent line from the deck AGE/AGE interface to the point of attachment of the Stage II fuel vent flexible lines in the tower.

(b) From this 2-inch vent line install a regulator back pressure reducing valve and a 4-inch vent to the atmosphere.

(c) At the point of attachment of the fuel vent flexible lines install a 2-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnect fittings.

(d) Install a 3-inch fuel vent line from the deck AGE/AGE interface to the point of attachment of the Stage I fuel vent flexible lines in the tower.

(e) From this 3-inch vent line install a regulator back pressure reducing valve and a 4-inch vent to the atmosphere.

(f) At the point of attachment of the fuel vent flexible lines install a 3-inch flexible line and a 1-inch flexible line and terminate these two lines with female quick disconnect fittings.

(3) Oxidizer fill and drain piping, Stage II.

(a) Install a 2-inch oxidizer fill and drain line from the deck AGE/AGE interface to the point of attachment of the Stage II oxidizer flexible line in the launch umbilical tower.

(b) Install the liquid level sensor probe in the 2-inch piping at a Conoseal connection.

(c) Install the 2-inch flexible line and the quick disconnect (female) at the end of the 2-inch line.

(d) Install the two sampling station hand valves, the two quick disconnects, and the connecting flexible line on this 2-inch line.

(4) Install the fuel fill and drain piping, Stage II.

(a) Install a 2-inch fuel fill and drain line from the deck AGE/AGE interface to the point of attachment of the Stage II fuel flexible line in the tower.

(b) Install the liquid level sensor probe in the 2-inch piping at a Conoseal connection.

(c) Install the 2-inch flexible line and the quick disconnect (female) at the end of the 2-inch line.

(d) Install the two sampling station hand valves, the two quick disconnects and the connecting flexible line on this 2-inch line.

(5) Stage I oxidizer jumper.

(a) Install the Stage I oxidizer jumper quick disconnects (D_G) and (D_H) and a 2-inch line down to the deck AGE/AGE interface (F_A).

(6) Stage I fuel jumper.

(a) Install the Stage I fuel jumper quick disconnects (D_J) and (D_K) and a 2-inch line down to the deck AGE/AGE interface (F_B).

(7) Stage II oxidizer jumper.

(a) Install three male quick disconnect fittings (D_A), (D_B), and (D_C) and interconnect with a 2-inch line.

(8) Install the Stage II fuel jumper.

(a) Install three male quick disconnect fittings (D_D), (D_E), and (D_F) and interconnect with a 2-inch line.

7.2.2.10 Deck Boom Piping Installation (Launch Position) (Fig. 7-12)

7.2.2.10.1 Install the deck boom piping at the LPUT in accordance with Drawings 424-9551130, 424-9552130 and 424-9553130.

(1) Oxidizer fill and drain lines, Stage I.

(a) Install a 3-inch oxidizer fill and drain line on the deck boom.

(b) Install a liquid level sensor probe at a Conoseal connection in the 3-inch piping.

(c) Install the two quick disconnects and the two sampling station hand valves and the flexible line connecting the two.

(d) Install a hand valve on the 3-inch line and connect to it a flexible line and terminate with a female quick disconnect (D_N).

(e) Install a 3-inch flexible line and quick disconnect (female) on the 3-inch line.

(2) Oxidizer jumper, Stage I.

(a) Install 2-inch piping from tower AGE/AGE interface (F_A) to the deck boom (oxidizer fill and drain) area.

(b) Install male quick disconnects (D_N) and (D_O) on this 2-inch line at the deck boom and convenient to the oxidizer flexible lines.

(3) Fuel fill and drain lines, Stage I.

(a) Install a 3-inch fuel fill and drain line on the deck boom.

(b) Install a liquid level sensor probe at a Conoseal connection in the 3-inch line.

(c) Install the two quick disconnects and two sampling station hand valves and the flexible line connecting the two.

(d) Install a hand valve on the 3-inch line and connect to it a flexible line and terminate with a female quick disconnect (D_M).

(e) Install a 3-inch flexible line and a quick disconnect from the end of the 3-inch line.

(4) Fuel jumper, Stage I.

(a) Install 2-inch piping from tower AGE/AGE interface (F_B) to the deck boom (fuel fill and drain) area.

(b) Install the two quick disconnects (male) (D_L) and (D_M) on this 2-inch line at the deck boom and convenient to the fuel flexible lines.

7.2.2.11 Pump Seal Drain and Pressure Sequencing Valve Drain Lines Installation (Launch Position) (Fig. 7-12)

7.2.2.11.1 Install the pump seal drain lines.

(1) Install oxidizer pump seal drain 1-inch tubing manifold in the thrust mount area with one 5/8-inch tubing takeoff and two 3/4-inch tubing takeoffs for connection of flexible lines.

(a) Install the 5/8-inch ID flexible hose at the takeoff. The flexible hose stretches to the engine compartment of the second stage where it makes a slip-on connection.

(b) Install the two 3/4-inch ID flexible hoses at these takeoffs. The hoses stretch to the engine compartment of the first stage where they make a slip-on connection.

(c) Install 1-inch oxidizer pump seal drain on launch deck.

(2) Install fuel pump seal drain 1-inch tubing manifold in the thrust mount area with one 5/8-inch tubing takeoff and two 3/4-inch tubing takeoffs for connection of the flexible lines.

(a) Install the 5/8-inch ID flexible hose at the takeoff. The flexible hose stretches to the engine compartment of the second stage where it makes a slip-on connection.

(b) Install the two 3/4-inch ID flexible hoses at the takeoffs. These hoses stretch to the engine compartment of the first stage where they make a slip-on connection.

(c) Install 1-inch fuel pump seal drain on the launch deck.

(3) Install pressure sequencing valve drain.

(a) Install 1-inch tubing from the fuel pump seal drain through two parallel solenoid valves to a 1/2-inch tubing manifold with two 1/2-inch tubing takeoffs in the thrust mount area.

(b) Install 1/2-inch ID flexible hoses at the two takeoffs. The hoses stretch to the first stage engine compartment where they make a slip-on connection.

7.2.3 Checkout Procedure

The PTPS transfers propellant from the holding area through a control and distribution center to the launch pad for loading aboard vehicle stages. The pneumatic system, in conjunction with the PTPS, provides the pressurization, blanketing and purging of vehicle and ground subsystems.

The ground system test, as outlined in GSTP 424-1033/AMR, verifies that fuel and oxidizer transfer, pressurization and venting systems components are properly installed, are compatible with facility installations, and that the overall system functions according to design specification.

7.2.3.1 Visual Inspection

7.2.3.1.1 Visually inspect the overall system to ascertain that units and piping comply with the following schematic drawings:

Drawing No.	Title
424-9550006	Propellant Transfer and Pressurization System, Dual Loading
424-9551006	Piping, Fuel Transfer System
424-9552006	Piping, Oxidizer Transfer System
424-9553006	Piping, Fluid Propellant Vent System
424-9154006	Piping, Pneumatic System

7.2.3.2 Nitrogen System Tests

7.2.3.2.1 Verify that the nitrogen pressurization for the fuel system is completely independent and separate from the nitrogen pressurization for the oxidizer system.

7.2.3.2.2 Verify that the nitrogen pressure controller unit is capable of supplying the specified nitrogen pressures to the various usage points.

7.2.3.2.3 Following the proof testing, check each subsystem for leakage when pressurized with nitrogen gas to the operating pressure specified. Hold pressure decay within fixed limits.

7.2.3.2.4 Test the following subsystems for the required flow rate using a high pressure at the primary nitrogen supply for the duration of the flow test to ensure proper test results:

(1) Nitrogen pressurization supply line.

(2) Launch vehicle pressurization system.

(3) Nitrogen supply to cleaning units.

(4) Nitrogen supply to V-96 cleaning unit (shared with Titan I).

(5) Tank blanket.

(6) Line and tank purge.

(7) 150-psig nitrogen supply.

(8) Nitrogen supply to tank truck.

(9) Ready storage vessel blanket.

7.2.3.3 Propellant Venting System Tests

7.2.3.3.1 Verify that the venting system is properly installed, that it withstands the working pressure and does not leak during operation.

7.2.3.3.2 Leak-check the propellant venting system including the flexible lines to Stages I and II.

7.2.3.3.3 Following proof testing, check each connection for leakage when pressurized with nitrogen gas mixed with helium.

7.2.3.3.4 After system has been pressurized, check the connections with a helium "sniffer." Hold leakage within fixed limits.

7.2.3.4 Propellant Transfer System Tests

7.2.3.4.1 Leak test. The leak test follows the subcontractor-conducted proof testing of the transfer systems.

(1) Leak test the transfer systems not including ready storage vessels with nitrogen gas mixed with helium. Exercise caution to prevent damage to the nitrogen pressurization and vent systems which are tied into the propellant transfer system.

(2) After system has been pressurized, check flanged connections, AN fittings, valve stems, etc., with leak detector fluid.

(3) Check welds with a Halogen leak detector.

(4) Correct evidence of leakage and test again.

7.2.3.4.2 Prior to the start of the flow check of the propellant transfer system, verify that the following checks have been accomplished:

(1) General inspection of PTPS and pneumatic system.

(2) Nitrogen system leak check.

(3) Electrical circuit and functional check.

(4) Propellant system leak check.

(5) Venting system leak check.

(6) Vapor combustion unit functional and electrical check.

(7) Temperature control unit functional check.

7.2.3.4.3 Operate the equipment to flow the propellant as indicated:

(1) From tank truck to the ready storage vessel (RSV).

(2) RSV to tank truck.

(3) Propellant circulation/temperature control unit.

(4) Vehicle and test position stage loading and unloading/vapor combustion unit (propellant vapor disposal).

NOTE: Stages of the launch vehicle are simulated in the flow check.

7.2.3.4.4 Pump the propellant into the first stage and into the second stage at the proper flow rate and pressure.

7.2.3.4.5 Unload the propellant into the holding tank at approximately the same rates as were used in loading.

7.2.4 Documentation

Document No.	Title
424-9550006	Schematic Propellant Transfer and Pressurization System, Dual Loading
424-1715011	Design Criteria, Propellant Transfer and Pressurization System
GSTP 424-1033/AMR	Propellant Transfer and Pressurization System
424-9553008	Test Specification, Propellant Venting Piping
424-9552008	Test Specification, Oxidizer Transfer System
424-9551008	Test Specification, Fuel Transfer System

Document No.	Title
424-9550009	Operating Procedure, Propellant Transfer and Control Systems
424-9551000	Fuel Transfer Piping System
424-9551006	Schematic, Piping Fuel Transfer System
424-9551110	Piping, Launch Pad, Fuel Transfer System
424-9551130	Piping, Launch Umbilical Tower Fuel Transfer System
424-9551140	Piping, Storage Area Fuel Transfer System
424-9551160	Piping, Test Umbilical Tower Fuel Transfer System
424-9552000	Oxidizer Transfer Piping System
424-9552006	Schematic, Piping Oxidizer Transfer System
424-9552110	Piping, Launch Pad, Oxidizer Transfer System
424-9552130	Piping, Launch Umbilical Tower Oxidizer Transfer System
424-9552150	Piping, Storage Area, Oxidizer Transfer System
424-9552160	Piping, Test Umbilical Tower, Oxidizer Transfer System
424-9553000	Propellant Vent Piping System
424-9553006	Schematic, Piping Fluid Propellant Vent System
424-9553110	Piping, Launch Pad, Propellant Vent System
424-9553130	Piping, Launch Umbilical Tower, Propellant Vent System
424-9553140	Piping, Fuel Storage Area, Propellant Vent System
424-9553150	Piping, Oxidizer Storage Area, Propellant Vent System

Document No.	Title
424-9553160	Piping, Test Umbilical Tower, Propellant Vent System
424-9154000	Pneumatic Piping System
424-9154006	Piping Schematic, Pneumatic System
	Fuel Holding Area
424-1515000	Installation, Fuel Transfer Control Unit
424-1515006	Schematic, Fuel Transfer Control Unit
424-1515010	Fuel Transfer Control Unit Assembly
424-1512000	Temperature Control Unit Propellant
424-1593000	Heat Exchanger and Circulating Units Installation (fuel)
424-1593006	Fluid Schematic (fuel), Heat Exchanger and Circulating Units
424-1593010	Heat Exchanger and Circulating Units (fuel)
424-1517000	Ready Storage Vessel Installation (fuel)
424-1517006	Fluid Schematic (fuel), Ready Storage Vessel
PS480200003	Propellant Ready Storage Vessel, 20,000-Gallon Capacity
	Oxidizer Holding Area
424-1514000	Installation, Oxidizer Transfer Control Unit
424-1514006	Schematic, Oxidizer Transfer Control Unit
424-1514010	Oxidizer Transfer Control Unit Assembly
424-1512000	Temperature Control Unit Propellant
424-1594000	Heat Exchanger and Circulating Units Installation (oxidizer)

Document No.	Title
424-1593006	Fluid Schematic (oxidizer), Heat Exchanger and Circulating Units
424-1593010	Heat Exchanger and Circulating Units (oxidizer)
424-1516000	Ready Storage Vessel Installation (oxidizer)
424-1516006	Fluid Schematic (oxidizer), Ready Storage Vessel
PS480200003	Propellant Ready Storage Vessel, 20,000-Gallon Capacity

Propellant and Nitrogen Distribution Shelter

424-1591000	Installation, Fuel Distribution Unit
424-1591006	Schematic, Fuel Distribution Unit
424-1591010	Fuel Distribution Unit Assembly
424-1592000	Installation, Oxidizer Distribution Unit
424-1592006	Schematic, Oxidizer Distribution Unit
424-1592010	Oxidizer Distribution Unit Assembly
424-1520000	Installation, Nitrogen Controller Unit
424-1520006	Schematic, Nitrogen Controller Unit
424-1520010	Nitrogen Controller Unit Assembly

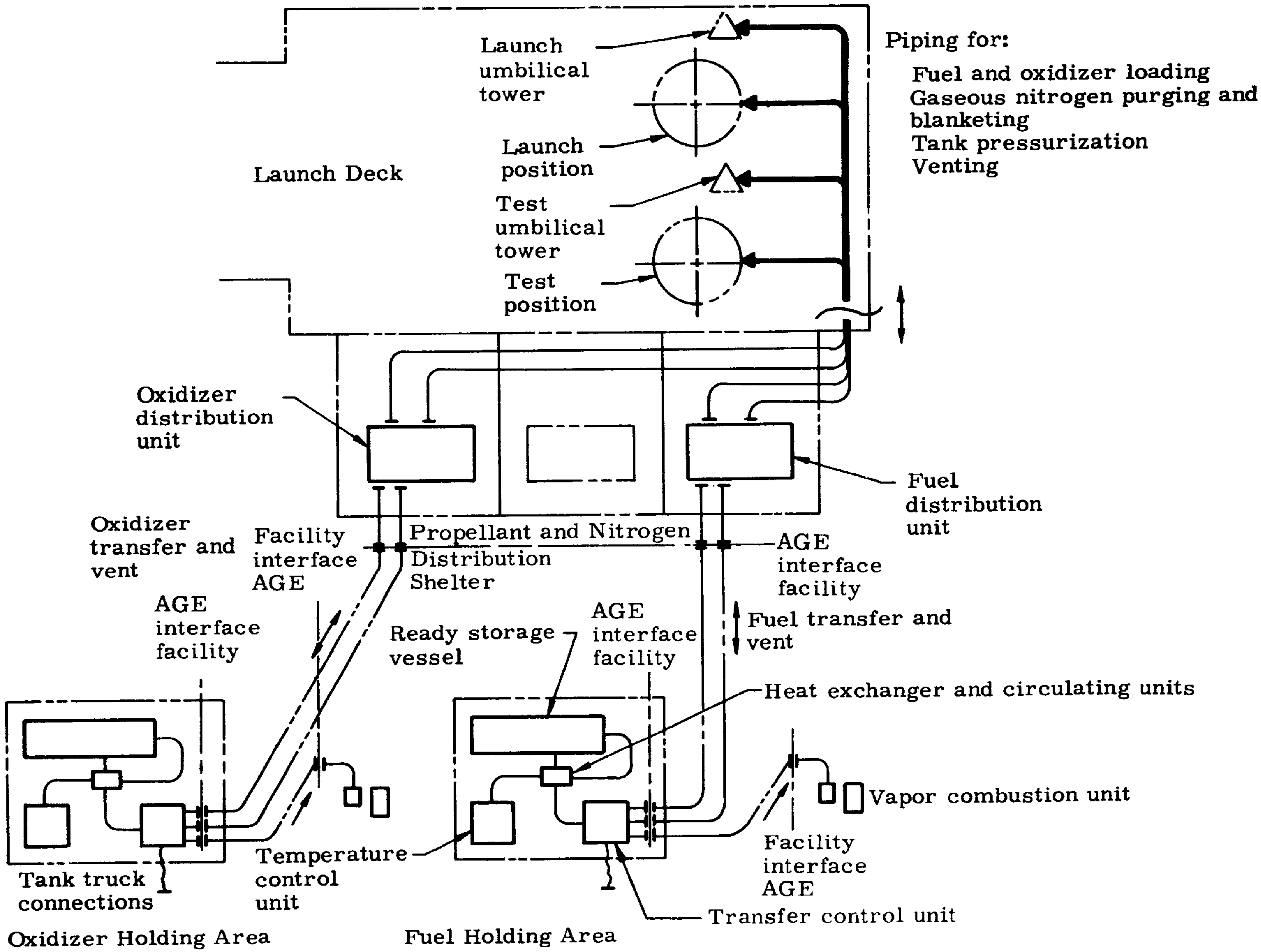


Fig. 7-7. Propellant Transfer and Pressurization System

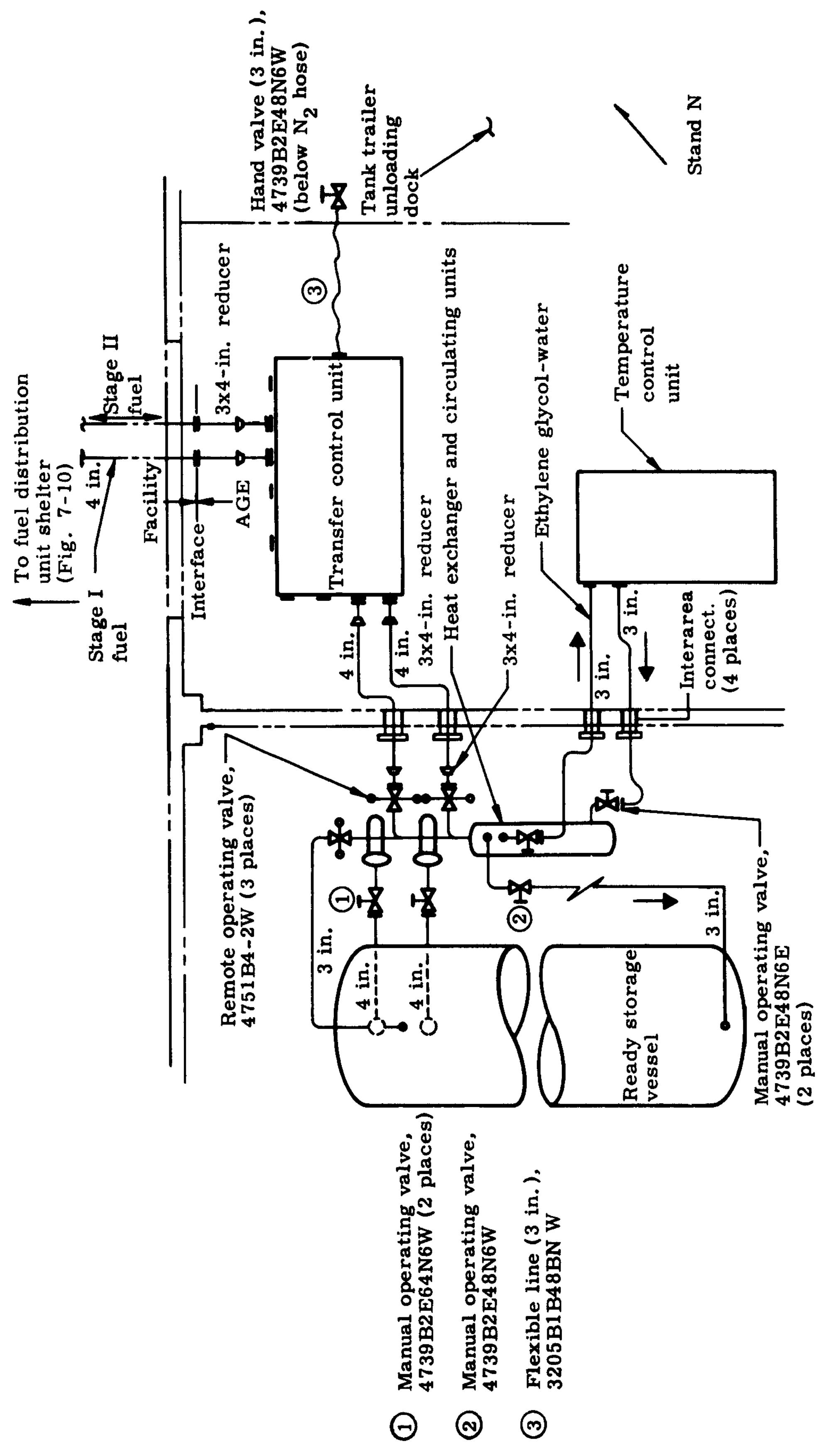


Fig. 7-8. Holding Area Fuel Piping

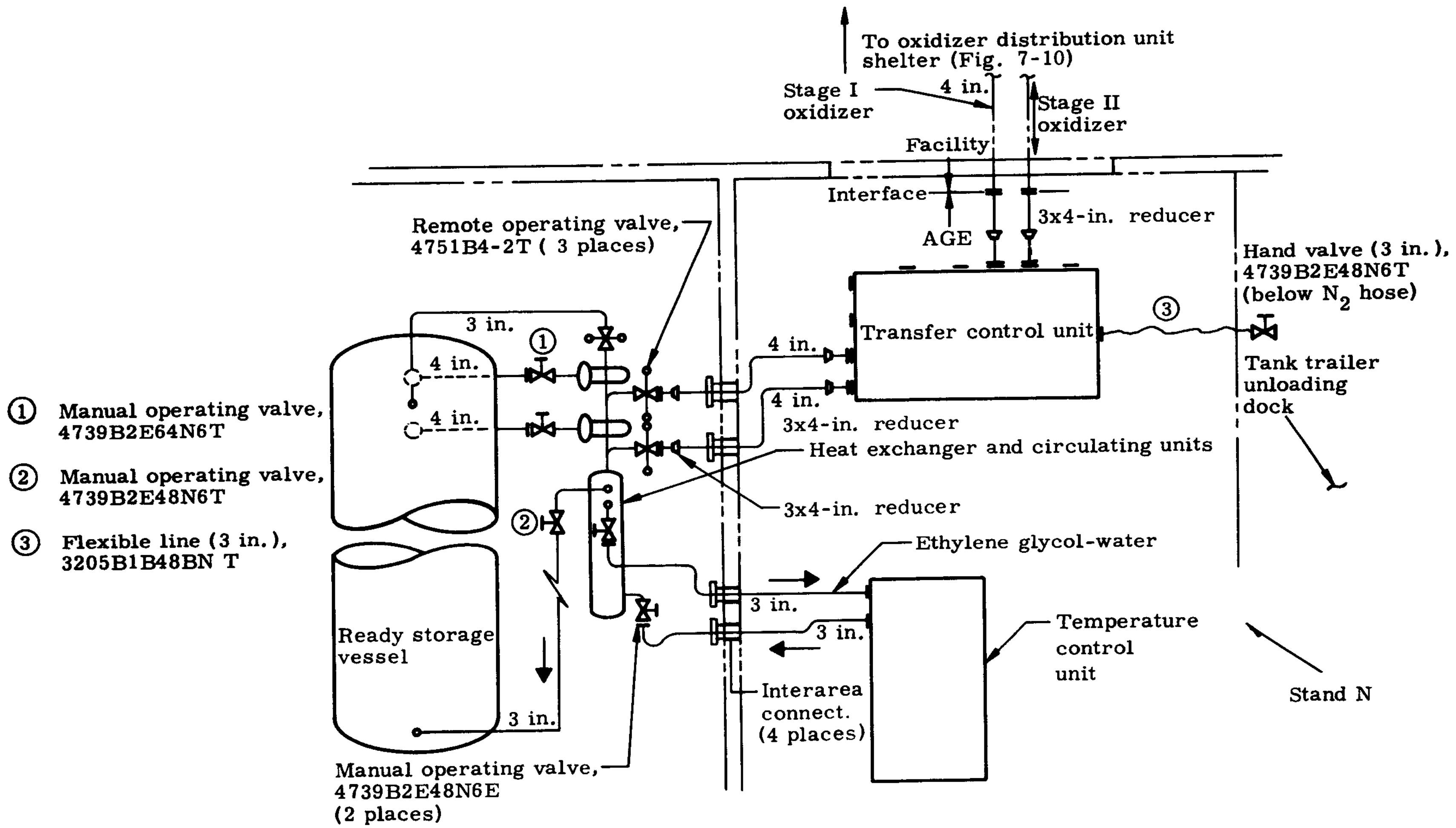


Fig. 7-9. Holding Area Oxidizer Piping

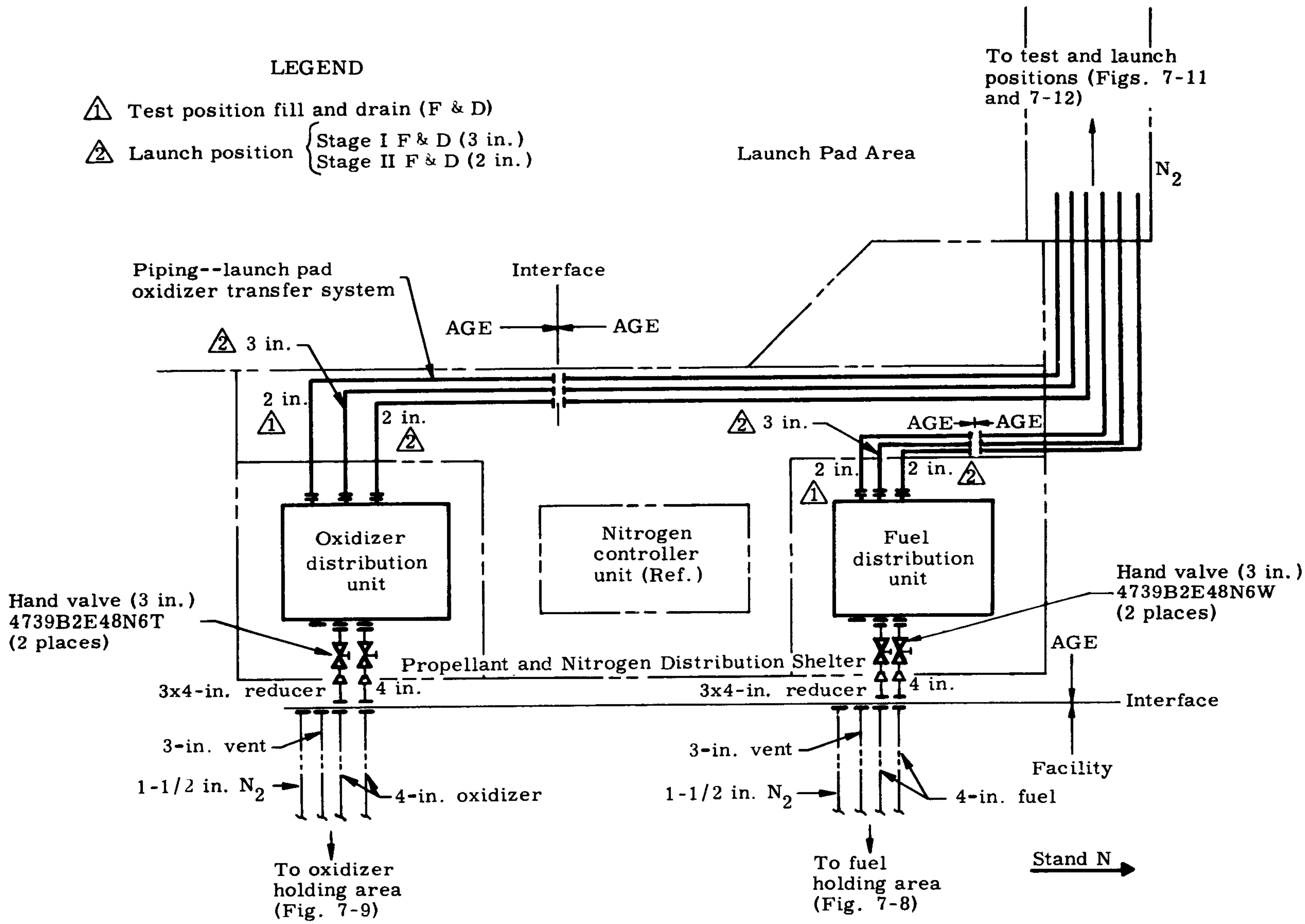
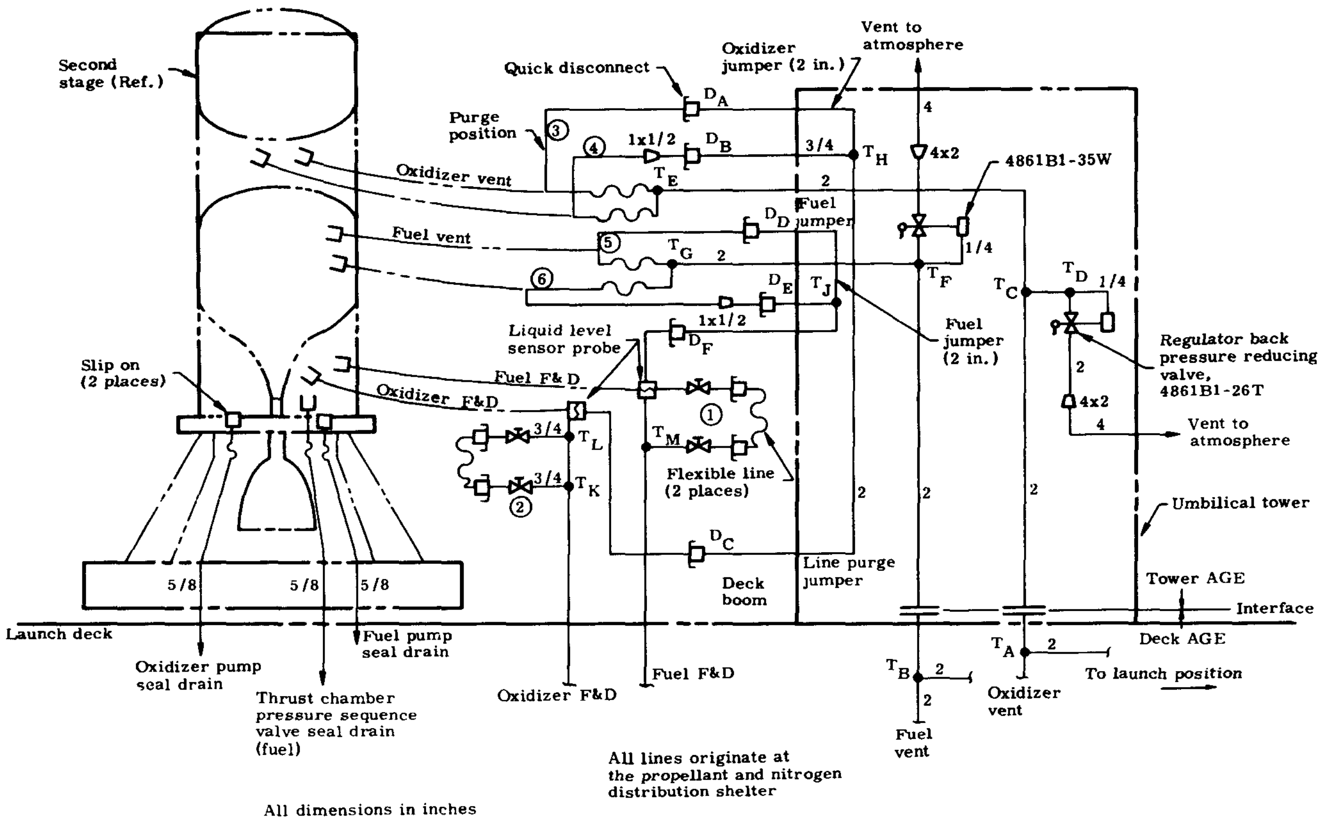


Fig. 7-10. Fuel and Oxidizer Transfer Piping--Launch Pad Area



Legend

1. Sampling station hand valve (1/2 in.) 4739B3-4RW

   Flexible line (1/2 in.) 32A1-8-0330, Quick disconnect 4851B1C8PW, Liquid sensor probe PS 831700010-019

2. Sampling station hand valve (3/4 in.) 4739B3-6RT

   Flexible line (3/4 in.) 32A1-12-0364, Quick disconnect 4851B1C12WT

3. Flexible line (2 in.) 3205B1B32 EN T
4. Flexible line (1 in.) 32A1-162, Quick disconnect (female) PS 485200009-007
5. Flexible line (2 in.) 3205B1B32 EN W, Quick disconnect (female) PS 485200007-003
6. Flexible line (1 in.) 32A1-162, Quick disconnect (female) PS 485200009-003
7. Quick disconnect (female) PS 485200007-007

Jumper quick disconnect (male)
$D_{A,C,F}$ PS 485200007-013

D_B PS 485200009-005
D_D PS 485200007-003
D_E PS 485200009-001

Fig. 7-11. Fuel, Oxidizer and Vent Piping--Test Position

1

NOTE:

All piping is direct lines from the propellant and nitrogen distribution shelter with the exception of second-stage vent piping:

Fuel (2 in.) vent comes from tee T_A at the test position.

Oxidizer (2 in.) vent comes from tee T_B at the test position.

See Figs. 7-10 and 7-15 for distribution shelter piping.
See Fig. 7-11 for test position piping.

LEGEND:

(1)(7) Hand valve (1/2 in.), 4739B3-4RW
{Flexible line (1/2 in.), 32A1-8-0330
{Quick disconnect, 4851B1C8PW (male)
Liquid level sensor probe, PS831700010-019

(2) Regulator back pressure reducing valve, 4861B1-35W

(3) Regulator back pressure reducing valve, 4861B1-26T

(4) Regulator back pressure reducing valve, 4861B1-33W

(5) Regulator back pressure reducing valve, 4861B1-34T

(6)(8) Hand valve (3/4 in.), 4739B3-6RT
{Flexible line (3/4 in.), 32A1 12-0364
{Quick disconnect, 4851B1C12AT (female)
Liquid level sensor probe, PS 831700010-019

(9) Solenoid valve, 4756B4-1W

(10) Hand valve (1/2 in.), 4739B3-4RT
{Flexible line (1/2 in.), 32A1-8-1950
{Quick disconnect, PS 485100002-039 (male)

(11) {Flexible line, 3205B1B32ENT
{Quick disconnect, PS485200007-003 (F)

(12) {Flexible line, 32A1-162
{Quick disconnect, PS485200009-007 (F)

(13) {Flexible line, 3205B1B32ENW
{Quick disconnect, PS485200007-003 (F)

(14) {Flexible line, 32A1-162
{Quick disconnect, PS485200009-003 (F)

(15) {Flexible line, 3205B1B32ENW
{Quick disconnect, PS485200007-003 (F)

(16) {Flexible line, 3205B1B32E NT
{Quick disconnect, PS485200007-007(F)

(17) {Flexible line, 3205B4E
{Quick disconnect, PS485200007-007 (F)

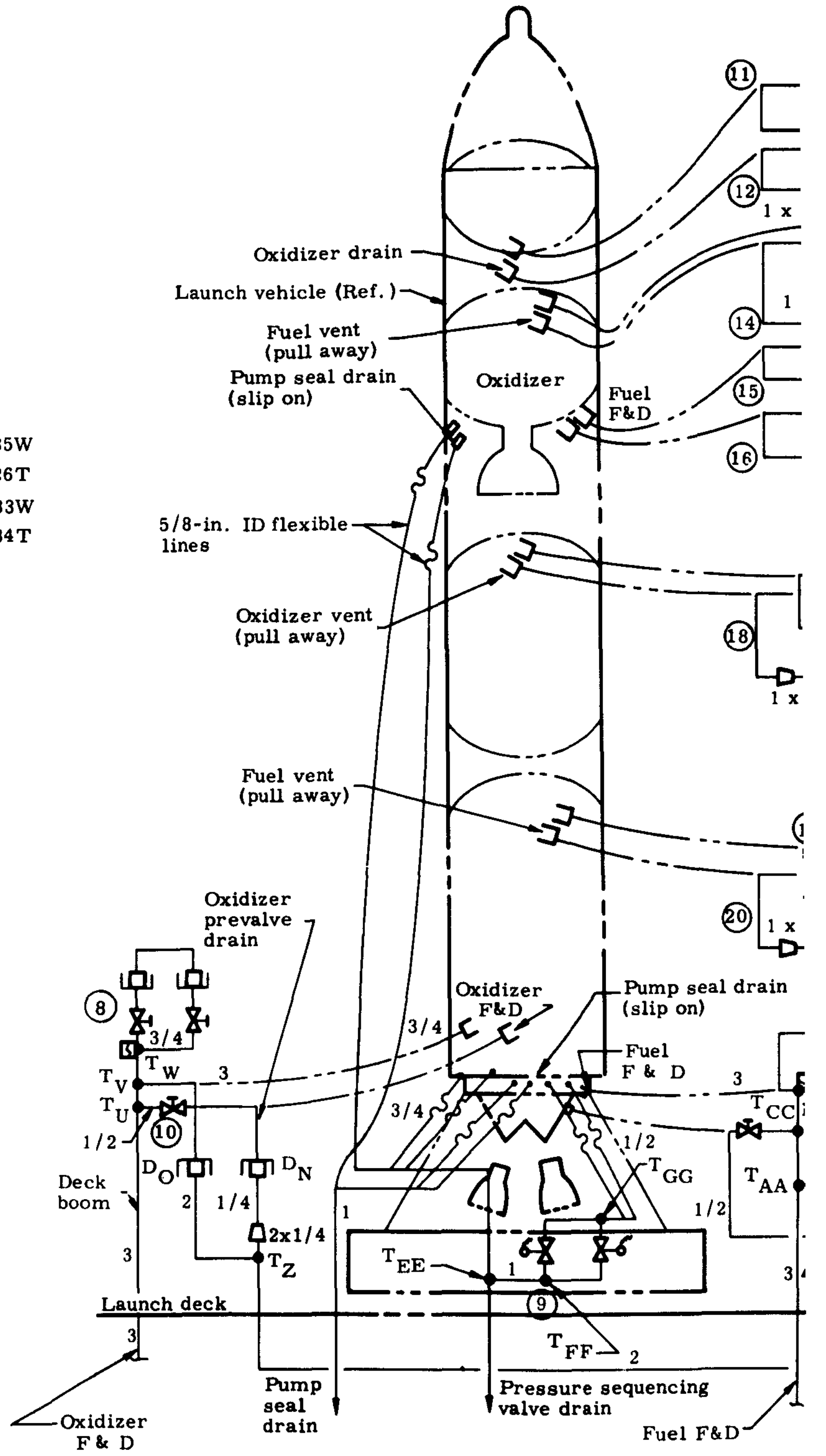
(18) {Flexible line, 32A1-162
{Quick disconnect, PS485200009-007 (F)

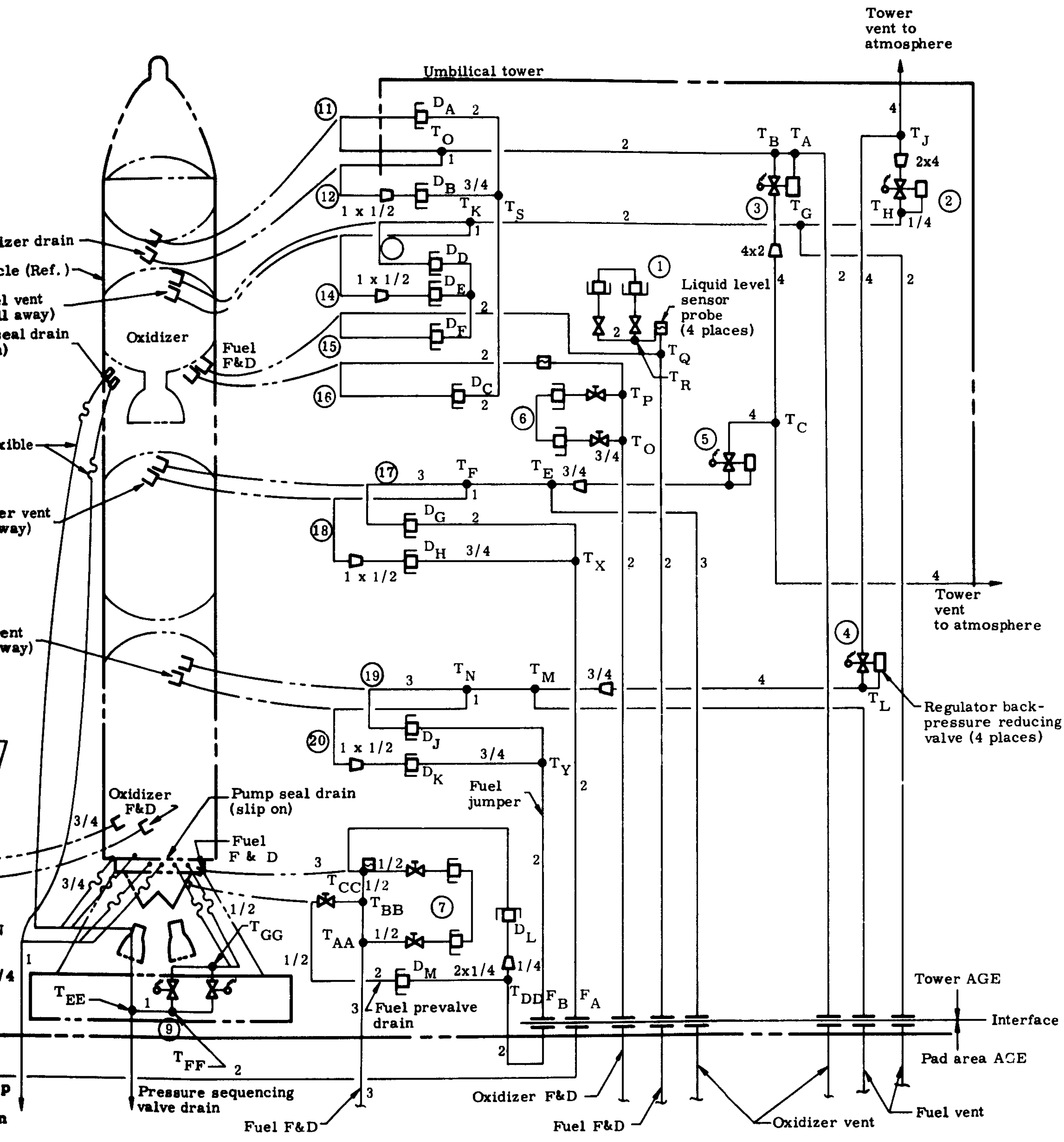
(19) {Flexible line, 32A1-162
{Quick disconnect, PS485200007-003 (F)

(20) {Flexible line, 32A1-162
{Quick disconnect, PS485200009-003 (F)

Jumper quick disconnect (male)

D_A	PS485200007-013	D_H	PS485200009-005
D_B	PS485200009-005	D_J	PS485200007-011
D_C	PS485200007-013	D_K	PS485200009-001
D_D	PS485200007-011	D_L	PS485100002-009
D_E	PS485200009-001	D_M	PS485200007-011
D_F	PS485200007-011	D_N	PS485100002-029
D_G	PS485200007-013	D_O	PS485200007-013





All dimensions in inches

Fig. 7-12. Fuel, Oxidizer and Vent Piping--Launch Position

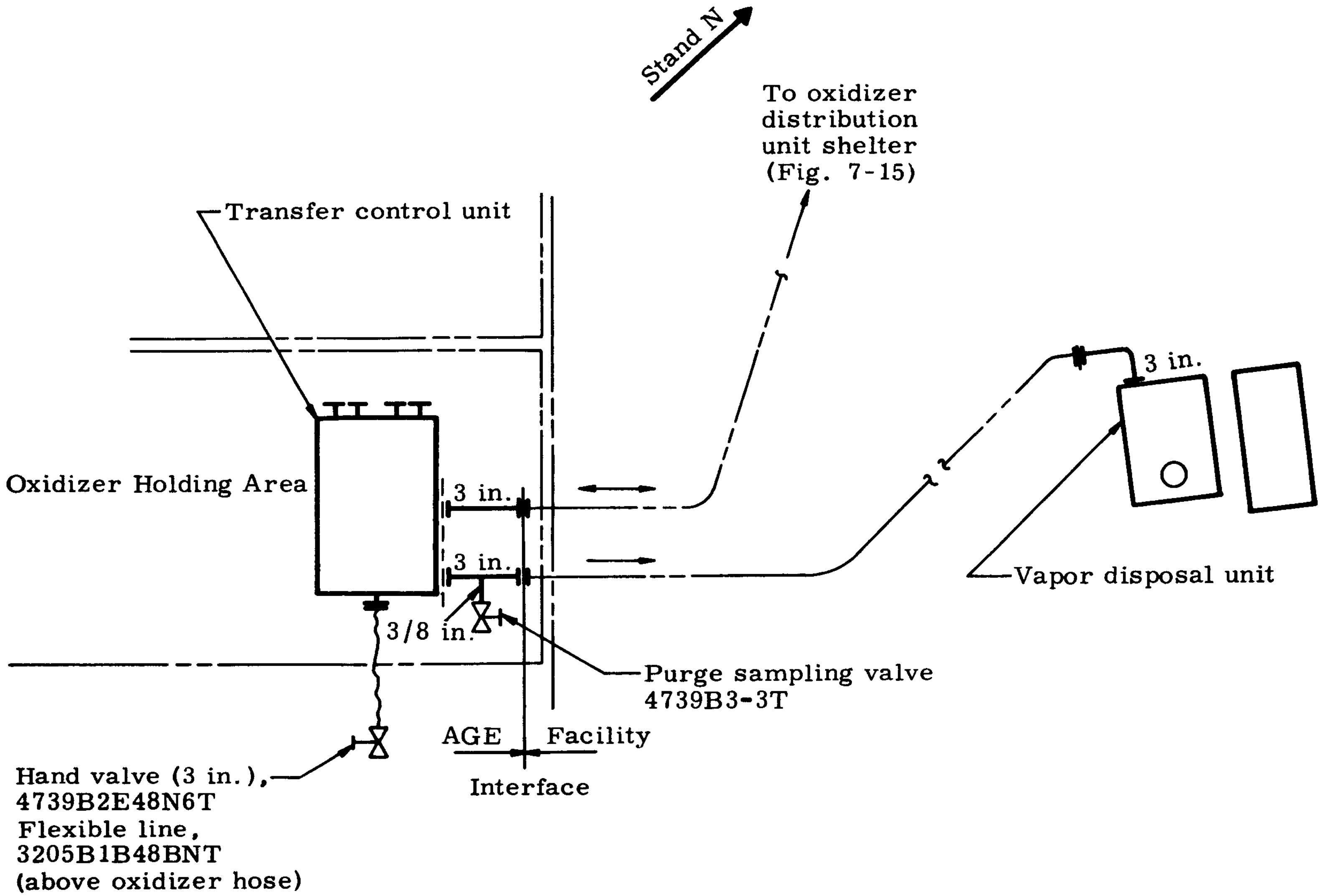


Fig. 7-14. Oxidizer Holding Area Vent Piping

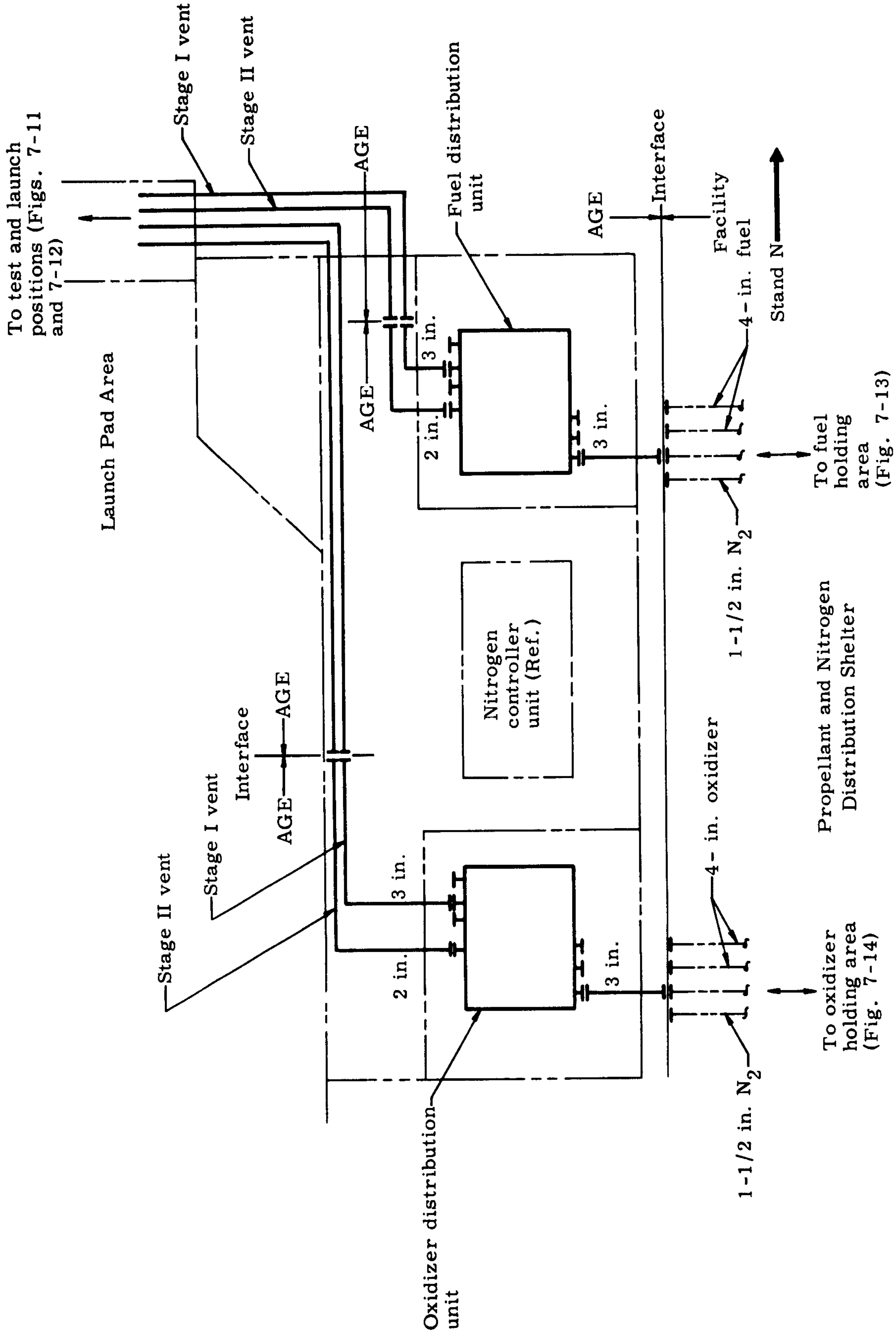


Fig. 7-15. Fuel and Oxidizer Vent Piping--Launch Pad Area

7.3 GROUND HYDRAULIC SYSTEM POWER SUPPLY AND PLUMBING INSTALLATION

7.3.1 Description

The Ground Hydraulic System supplies and distributes hydraulic pressure and flow to the hydraulic components of the Complete Vehicle Erector (CVE) and the Stage II Erector. The complete system includes the Ground Hydraulic Power Supply Unit (CP 4830), referred to as the C-11 unit, and the Ground Hydraulic System plumbing installation (CP 9160). The plumbing installation includes piping and tubing and the associated pressure gages, pressure switches, valves, flexible hoses, filters and fittings required to deliver the hydraulic fluid at the prescribed pressures and flows to the respective equipment on the erectors.

The plumbing installation is patterned basically after the Titan II design for Launch Complex 15, with appropriate changes to meet Gemini requirements (804C9160000, Hydraulic System, Ground Installation, Complex 15). The major change in the design will be the addition of plumbing to and up the Stage II Erector.

The hydraulic power supplied to the CVE and the Stage II Erector performs the following functions:

(1) Cushions the motion of the erectors after they pass the balance point and until they reach the final vertical position.

(2) Initiates the lowering of the erectors from the vertical position until the electric winch begins to assume the load.

(3) Folds and unfolds the AGE work platforms and handrails on the erectors.

(4) Locks the two legs of the erectors which are opposite the hinged legs when the erectors are in a vertical position, and unlocks the legs just prior to lowering the erectors.

Figure 7-16 presents a block diagram of the Ground Hydraulic Power Supply System.

All component parts of the complete system are refurbished according to Operations Directive 3040-4000-4S. All plumbing is of flared-end stainless steel tubing.

The description of equipment in the hydraulic equipment room is presented before the interconnection of this equipment is described. Time required for the installation and interconnection of this equipment is given as for one single task.

7. 3. 2 Sequence of Events

7. 3. 2. 1 C-11 Unit Installation

7. 3. 2. 1. 1 Install the C-11 unit in the hydraulic equipment room (424-9160110, sheet 2) on the north side of the first floor of the approach ramp building.

The C-11 unit is refurbished according to Operations Directive 3040-4000-4S; modifications to the unit are made according to 424-4830000.

The C-11 unit is located with one end to the north wall and the control panel facing west, on the floor area of Locations 206 and 207.

The C-11 unit is secured to the deck by four dogs bolted into the deck.

The electrical connections to the C-11 unit are described in Section 7. 1.

7. 3. 2. 1. 2 Construct and install the CVE and Stage II erector actuator control panel as shown by 424-9160110, sheet 2.

The erector actuator control panel is designed and constructed (424-9160110, sheet 2) to replace the formerly used separate console. The control panel is mounted above the C-11 unit, suspended from the ceiling. The panel has pressure gages which indicate the pressures on the various hydraulic lines of the system.

7. 3. 2. 1. 3 Install the high pressure line filter system (25-micron filter) behind (east of) the C-11 unit as shown by 424-9160110, sheet 2.

7. 3. 2. 2 Below Deck Hydraulic Plumbing

7. 3. 2. 2. 1 Connect the hydraulic pressure output line from the C-11 unit (Location C, Fig. 7-17) to the input connection of the filter.

7. 3. 2. 2. 2 Connect the water inlet (Location F, Fig. 7-17) and the water outlet (Location G, Fig. 7-17) on the C-11 unit to the building facility water lines. The water is used as a coolant in the heat exchanger of the C-11 unit.

7.3.2.2.3 Connect the vapor exhaust vent (Location A, Fig. 7-17) of the C-11 unit to the exhaust stack of the building facility.

7.3.2.2.4 Connect the nitrogen inlet on the C-11 unit (Location B, Fig. 7-17) to the building AGE nitrogen supply.

7.3.2.2.5 Install and connect the lines from the filter, the control panel and the C-11 unit to the CVE actuator as shown by 424-9160110, sheets 2 and 3, and 424-9160106.

(1) Install and connect line 6, a 1-1/4-inch line, from the filter to the CVE actuator.

(2) Install and connect line 1, a 1-1/4-inch return line, from the CVE actuator through pressure reducers to Location D on the C-11 unit.

(3) Install pressure gage tubes from line 6 and line 1 to the corresponding pressure gages on the erector actuator control panel.

(4) Install and connect the hydraulic drain, line 4, a 1/2-inch line, from the CVE actuator to the vent reservoir on the C-11 unit at Location H.

(5) Install and connect the hydraulic drain, line 5, a 1/2-inch line, from the CVE actuator to Location E on the C-11 unit.

7.3.2.2.6 Install and connect the lines from the filter, the control panel and the C-11 unit to the Stage II erector actuator as shown by 424-9160110, sheets 2 and 3, and 424-9160107.

(1) Install and connect line 100, a 1-1/4-inch line, from the filter through a pressure-regulating valve to the Stage II erector actuator.

(2) Install pressure gage tube from line 100 to the appropriate pressure gage on the erector actuator control panel.

(3) Install and connect the line 1 branch, which starts from line 1 and proceeds to the Stage II erector actuator. Line 1 is the return line from the actuator which connects, through

pressure reducers to Location D on the C-11 unit.

(4) Install and connect the branch of the hydraulic drain, line 4, a 1/2-inch line, from the Stage II erector actuator to the main line 4. Line 4 connects to the vent reservoir on the C-11 unit at Location H.

(5) Install and connect the branch of the hydraulic drain, line 5, a 1/2-inch line, from the Stage II erector actuator to the main line 5. Line 5 connects to Location E on the C-11 unit.

7.3.2.2.7 Install the main feeder (line 2) and the return (line 3) for hydraulic power supplied to the leg locks and to the erector platforms of both erectors (Fig. 7-18) as shown by 424-9160110, sheet 3.

(1) Install and connect line 2, a 1-1/4-inch line, from the filter running to a tee fitting (T-1, Fig. 7-18).

(2) Install and connect return line 3, a 1-1/4-inch line running to a tee fitting (T-2).

(3) Install pressure gage tubes from line 2 and line 3 to the corresponding pressure gages on the erector actuator control panel.

7.3.2.2.8 Install branches of lines 2 and 3 from T-1 and T-2, to actuate the west leg lock of the CVE (Fig. 7-18).

(1) Connect these branches of lines 2 and 3 by a purge valve (V-1).

(2) Install and connect branches of lines 2 and 3 through a solenoid valve and a manual valve, to the west leg lock of the CVE.

7.3.2.2.9 Install branches of lines 2 and 3 to supply hydraulic power to the east leg lock of the CVE, to the west leg lock of the Stage II erector, and to both erectors for the purpose of actuating the movable work platforms, the handrails and the platform locking bars (Fig. 7-18).

(1) Install branches of lines 2 and 3 from T-3 and T-4 extending north to cross fittings (C-1 and C-2). From C-1 and C-2 install two branches extending east to the vertical lines for the Stage II erector work platforms (424-9160108). Also, from C-1 and C-2, extend two branches west to the vertical lines for the CVE work platforms (424-9160109).

(2) Install branches of lines 2 and 3 from C-1 and C-2 (already installed), through a solenoid valve and a manual valve, to the east leg lock of the CVE.

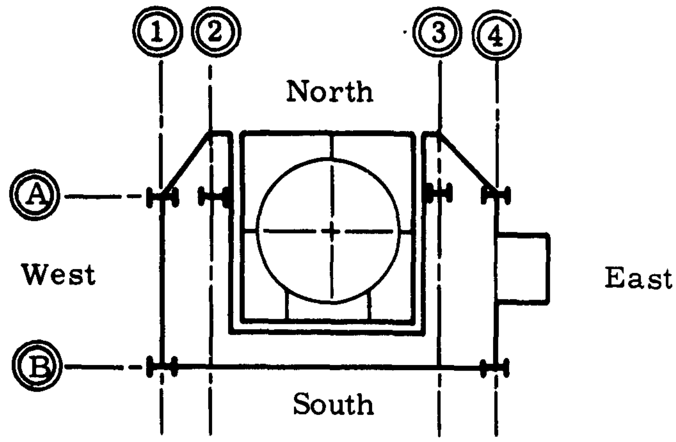
(3) Install a purge valve (V-2) between lines 2 and 3 at this point. From these two branches of lines 2 and 3 at T-5 and T-6 install two branches and attach, through a solenoid valve and a manual valve, to the west leg lock of the Stage II erector.

7.3.2.2.10 Install two branches from lines 2 and 3 to supply hydraulic power to the east leg lock of the Stage II erector.

(1) Install and connect branches of lines 2 and 3 from T-1 and T-2, through a solenoid valve and a manual valve, to the east leg lock of the Stage II erector. Install a purge valve (V-3) between lines 2 and 3 at this point.

7.3.2.3 Feeder Lines and Work Platform Actuator Control Panels Installation and Connection, Stage II Erector

In this paragraph, identification of the structural columns of the Stage II erector by notations such as "Column 1-A" utilizes the coordinate system shown in the sketch on the following page.



Key Plan, Stage II Erector

7.3.2.3.1 Install and connect two feeder lines, from the plumbing already installed (paragraph 7.3.2.2.9) beneath the launch deck, running vertically up the Stage II erector. Also, install the work platform actuator control panels at the various elevations (424-9160006, sheet 6).

(1) Construct and install the work platform actuator control panels at a convenient height for manual operation above each of the following platform elevations: 20 feet, 8 inches; 30 feet, 5-1/8 inches; and 38 feet, 6-1/8 inches (424-9160108, sheets 2 and 3). Each panel contains three manual valves for actuating the movable sections of the work platforms at the respective elevations. The panels are installed on the inside of the east face of the Stage II erector adjacent to Column 4-B.

(2) Install two flexible hoses (lines 1 and 2) from the deck plumbing (paragraph 7.3.2.2.9), as shown by 424-9160108, sheet 2, and 424-9160110, running past the pivot of the Stage II erector and connect to tubing running vertically up the erector to an elevation of 38 feet, 6-1/8 inches.

(3) Connect lines 1 and 2 to the work platform actuator control panel at each elevation. Connect lines 1 and 2 together with a purge valve above the control panel at the 38-foot, 6-1/8-inch elevation.

7.3.2.4 Tube Lines Installation and Connection at 20-Foot, 5/16-Inch Work Platform Elevation, Stage II Erector

7.3.2.4.1 Install and connect tube lines extending from the work platform actuator control panel to the hydraulic actuators already installed on the platform at the 20-foot, 5/16-inch elevation (424-9160006, sheet 6, and 424-9160108, sheet 3).

Hydraulic actuators are located at seven places about the platform to: (1) fold the movable platform sections, (2) fold the movable handrail and (3) move the locking bar on the north face movable platform sections. Flexible hoses connect the tube line branches to the actuators and connect the tube lines across the hinge joints of the platforms.

(1) Install and connect tube lines from the control panel to the two east side platform section actuators and the north platform locking bar which locks across the north-south centerline.

(2) Install and connect tube lines from the control panel, to the single south side platform section actuator.

(3) Install and connect tube lines from the control panel, to the two west side platform section actuators and the one north side handrail actuator.

7.3.2.5 Tube Lines Installation and Connection at 30-Foot 5-5/16-Inch Work Platform Elevation, Stage II Erector

7.3.2.5.1 Install and connect tube lines at the 30-foot 5-5/16-inch elevation extending from the work platform actuator control panel to the six hydraulic actuators already installed on the platform (424-9160006, sheet 6, and 424-9160108, sheet 3).

(1) Install and connect the tube lines at this elevation exactly as at the 20-foot 5/16-inch elevation (paragraph 7.3.2.4) except that there is no locking bar across the north-south platform centerline on the north side.

7.3.2.6 Tube Lines Installation and Connection at 38-Foot 6-5/16-Inch Work Platform Elevation, Stage II Erector

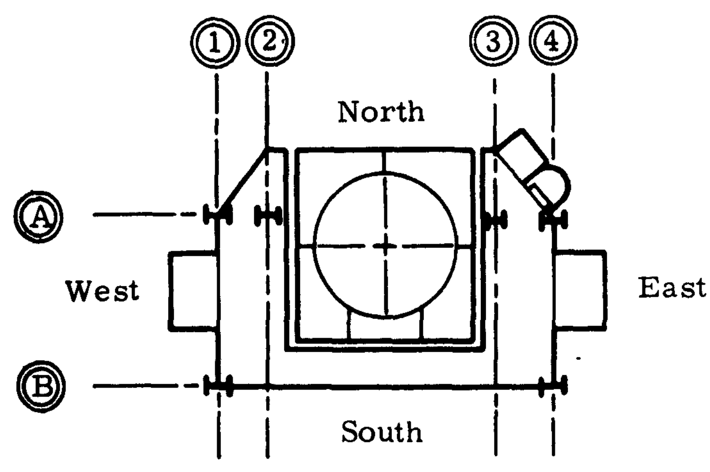
7.3.2.6.1 Install and connect tube lines at the 38-foot 6-5/16-inch elevation extending from the work platform actuator control panel to the seven hydraulic actuators already installed on the platform (424-9160006, sheet 6, and 424-9160108, sheet 3).

(1) Install and connect the tube lines at this elevation exactly as at the 20-foot 5/16-inch elevation except for the number of flexible hose connections. Five actuators operate the five movable platform sections while two actuators operate the two movable handrail sections on the north face.

7.3.2.7 Feeder Lines and Work Platform Actuator Control Panels Installation and Connection, Complete Vehicle Erector

7.3.2.7.1 Install and connect two feeder lines, from the plumbing already installed (paragraph 7.3.2.2.9) beneath the launch deck, running vertically up the CVE; also, install the work platform actuator control panels at the various elevations as shown by 424-9160109, sheet 2.

In this paragraph, identification of the structural columns of the CVE by notations, such as "Column 1-A," utilizes the coordinate system on the following sketch.



Key Plan, Complete Vehicle Erector

Construct and install the work platform actuator control panels at a convenient height for manual operation at eight locations on the CVE as shown in Table 7-1.

TABLE 7-1

Locations of Work Platform Actuator Controls on the CVE

Elevation (ft-in.)	Drawing No.	Location of Control Box*	Number of Valves
9-8	424-9160109, Sheets 4 and 3	East face at Column 4-B	1
35-4	424-9160109, Sheets 5 and 3	West face at Column 1-B	3
60-6	424-9160109, Sheet 5	West face at Column 1-B	3
70-3	424-9160109, Sheet 3		
80-8			
91-2	424-9160109, Sheets 4 and 3	East face, midway along Column Row 4	3
100-2	424-9160109, Sheet 4	East face, midway along Column Row 4	3
109-2	424-9160109, Sheet 4	East face, midway along Column Row 4	4

*These locations are shown on a view of the south face of the erector by 424-9160109, sheet 2.

(1) Install two flexible hose connections from the deck plumbing (paragraph 7.3.2.2.9) as shown by 424-9160109, sheet 2, running past the pivot of the CVE and connect to tubing running vertically up the erector to the 109-foot, 2-inch elevation.

(2) Connect the two vertical tube lines to the work platform actuator control panels at all elevations.

(3) Above the control panel at the 109-foot 2-inch elevation, connect the lines with a purge valve as shown by 424-9160109, sheet 2.

7.3.2.8 Tube Lines Installation and Connection at 9-Foot 8-Inch Work Platform Elevation, Complete Vehicle Erector

7.3.2.8.1 Install and connect two tube lines at the 9-foot 8-inch elevation from the work platform actuator control panel and join by flexible hose connections to the actuator at the northeast corner which raises the north face work platform (424-9160109, sheet 3, and 424-9160006, sheet 3).

7.3.2.9 Tube Lines Installation and Connection at 35-Foot 4-Inch Work Platform Elevation, Complete Vehicle Erector

7.3.2.9.1 Install and connect tube lines at the 35-foot 4-inch elevation extending from the work platform actuator control panel to the five hydraulic actuators already installed on the platform (424-9160109, sheet 3, and 424-9160006, sheet 3).

(1) Install four tube lines from the control panel and connect by flexible hose connections to the two actuators which raise the two movable sections of the east side platform.

(2) Install two tube lines from the control panel and connect by flexible hose connections to the actuator which raises the movable section of the south side platform.

(3) Install four tube lines from the control panel and join by flexible hose connections to the two actuators which raise the movable sections of the west side platform.

7.3.2.10 Tube Lines Installation and Connection at 60-6, 70-3 and 80-Foot 8-Inch Work Platform Elevations, Complete Vehicle Erector

7.3.2.10.1 Install and connect tube lines at the 60-6, 70-3 and 80-foot 8-inch elevations, extending from the work platform actuator control panels to the seven hydraulic actuators already installed on the platforms at each of these elevations (424-9160109, sheet 3, and 424-9160006, sheets 3 and 4).

The following discussion is typical of each of the three levels.

(1) Install six tube lines from the control panel and connect by flexible hose connections to the two actuators which raise the two movable sections of the east side platform and to the actuator which operates the platform locking bar across the north-south centerline at the north side.

(2) Install two tube lines from the control panel and join by flexible hose connections to the actuator which raises the movable section of the south side platform.

(3) Install six tube lines from the control panel and connect by flexible hose connections to the two actuators which raise the two movable sections of the west side platform and to the actuator which raises and lowers the north face guardrail.

7.3.2.11 Tube Lines Installation and Connection at 91-Foot 2-Inch Work Platform Elevation, Complete Vehicle Erector

7.3.2.11.1 Install and connect tube lines at the 91-foot 2-inch elevation extending from the work platform actuator control panel to the six hydraulic actuators already installed on the platform (424-9160109, sheet 3, and 424-9160006, sheet 5).

(1) Install four tube lines from the control panel and connect by flexible hose connections to the actuator which raises the northeast section of the platform and to two actuators which operate the two locking bars across the north platform section.

(2) Install two tube lines from the control panel and join by two flexible hose connections to the actuator which raises the southeast platform section.

(3) Install four tube lines from the control panel and connect by flexible hose connections to the two actuators whicn raise the two west sections of the platform.

7.3.2.12 Tube Lines Installation and Connection at 100-Foot 2-Inch Work Platform Elevation, Complete Vehicle Erector

7.3.2.12.1 Install and connect tube lines at the 100-foot 2-inch elevation extending from the work platform actuator control panel to the six hydraulic actuators already installed on the platform, as shown by 424-9160109, sheet 4, and 424-9160006, sheet 5.

This installation is the same as that described for the 91-foot 2-inch elevation (paragraph 7.3.2.11).

7.3.2.13 Tube Lines Installation and Connection at 109-Foot 2-Inch Work Platform Elevation, Complete Vehicle Erector

7.3.2.13.1 Install and connect tube lines at the 109-foot 2-inch elevation extending from the work platform actuator control panel to the four hydraulic actuators already installed on the platform (424-9160109, sheet 4, and 424-9160006, sheet 5).

This installation is the same as that described for the 100-foot 2-inch elevation (paragraph 7.3.2.18) except that the two actuators for the locking bars of the north platform sections are omitted.

7.3.3 Checkout Procedure

7.3.3.1 Visually inspect the complete system to determine compliance with the design criteria and specifications (i.e., all components are properly installed and adequately secured).

7.3.3.2 Check and calibrate all pressure and temperature gages.

7.3.3.3 Fill the complete system with the proper amount of the specified hydraulic fluid, filtering the fluid while filling.

7.3.3.4 With the isolation valve closed, alternately test the primary pump of the C-11 unit, the secondary pump, and then both pumps at once, at various pressures for sustained periods, making periodic pressure and temperature readings.

7.3.3.5 Purge the pressure and return system of air.

7.3.3.6 With the erector in the horizontal position and the isolation valve open, conduct proof-pressure tests of the CVE and the Stage II erector actuator systems, the leg lock systems and the erector subsystems, at both high and low pressures for sustained periods, making periodic pressure and temperature readings during the tests.

7.3.3.7 Correct the source of any external leakages, failures or permanent deformation.

7.3.3.8 Flush the complete Ground Hydraulic System and take samples from the return line to inspect for foreign particle size and concentration.

7.3.3.9 Tie all folding handrails and work platform sections securely to the erector structures, with the folding sections in a folded position.

7.3.3.10 Test the CVE and the Stage II erector through two complete cycles of raising, locking and unlocking the legs, and lowering.

7.3.3.11 Test the movement of the work platform sections and the movable handrails through two complete cycles. Exert a sustained external force on each movable section to test for deflections.

This is a brief and general description of the principal elements of the checkout procedure for the Ground Hydraulic System installation. A complete description is given by Ground System Test Procedure, Ground Hydraulic System, 424-1041/AMR.

7.3.4 Documentation

Document No.	Title
424-2152000	AGE Installation, Approach Ramp Building, First Floor, Complex 19
424-4830000	Power Supply, Hydraulic, C-11 Unit, AGE
424-4830015	Tube Assembly, Hydraulic Power Supply
424-4830016	Placard Schematic, Hydraulic Power Supply
424-9160000	Hydraulic System, Ground Installation, Complex 19, AMR

Document No.	Title
424-9160006	Schematic Diagram, Hydraulic System, Test Stand P-19 (Stage II erector)
424-9160106	Plumbing Installation, Hydraulic System, Erector Actuator "A", Stand P-19
424-9160107	Plumbing Installation, Hydraulic System, Erector Actuator "B", Stand P-19
424-9160108	Plumbing Installation, Hydraulic System, Second-Stage Erector, Stand P-19
424-9160109	Plumbing Installation, Hydraulic System, Complete Vehicle Erector, Stand P-19
424-9160110	Plumbing Installation, Hydraulic System, Test Stand, Stand P-19
804C9160000	Hydraulic System, Ground Installation, Complex 15
424-1041/AMR	Ground System Test Procedure, Ground Hydraulic System

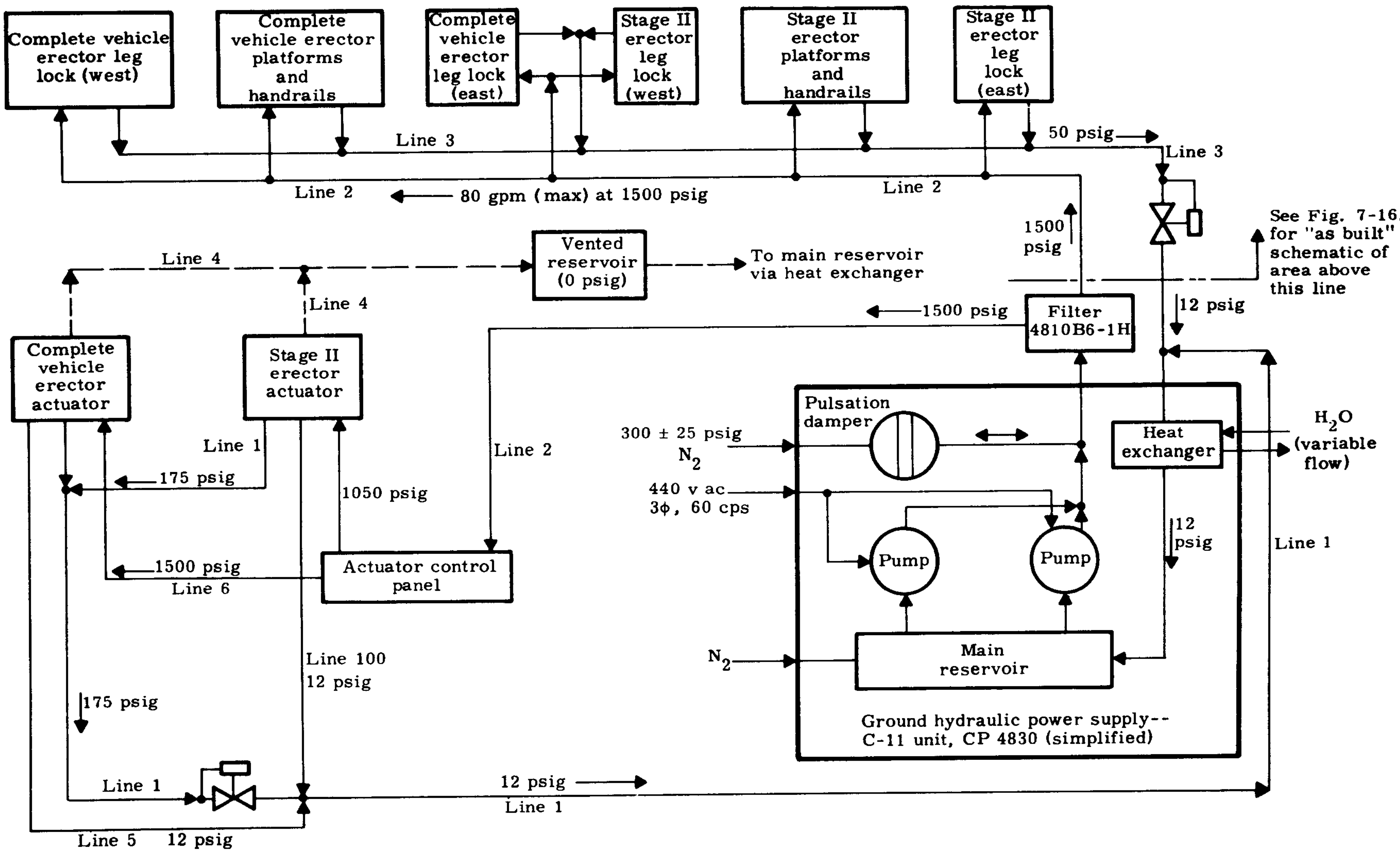


Fig. 7-16. Ground Hydraulic Power Supply System Plumbing Installation, Ground Hydraulic System, AMR (CP 9160)

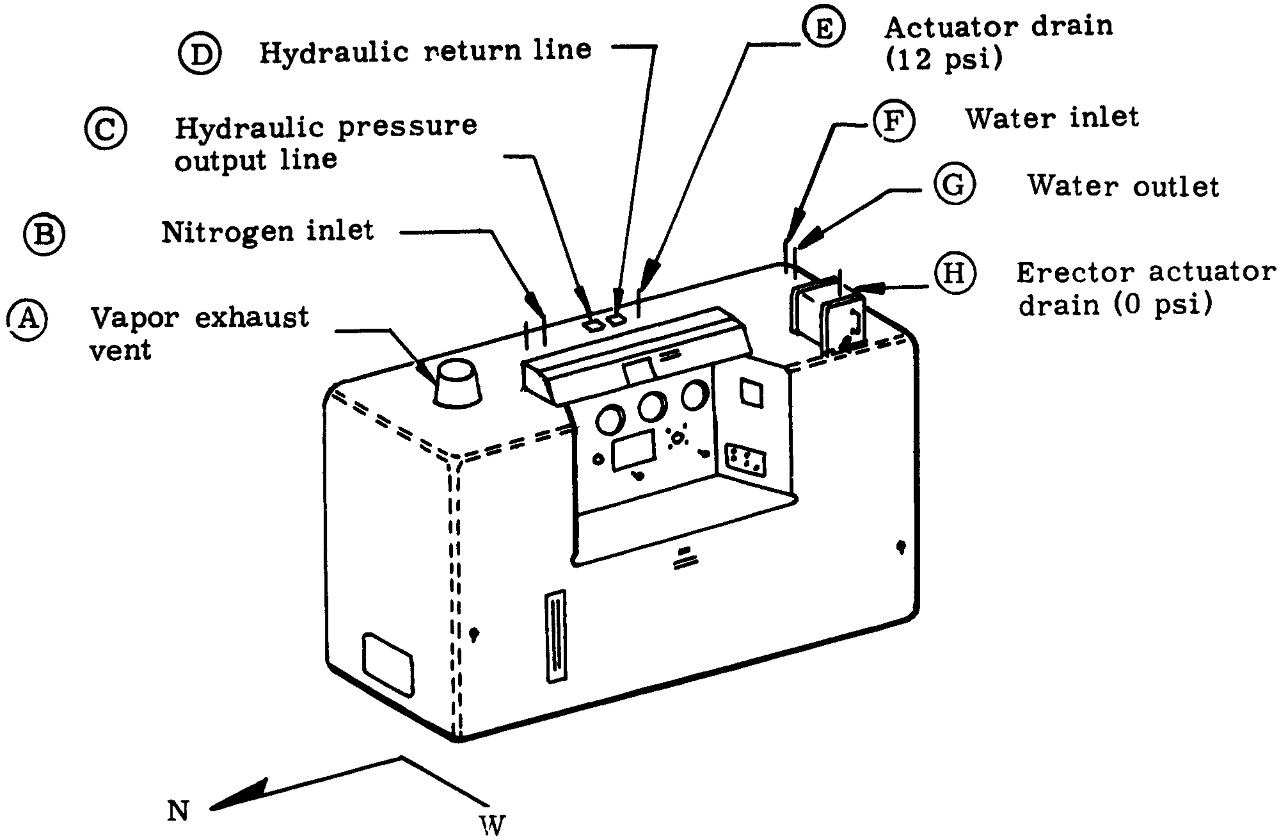


Fig. 7-17. C-11 Unit, Ground Hydraulic Power Supply (CP 4830)

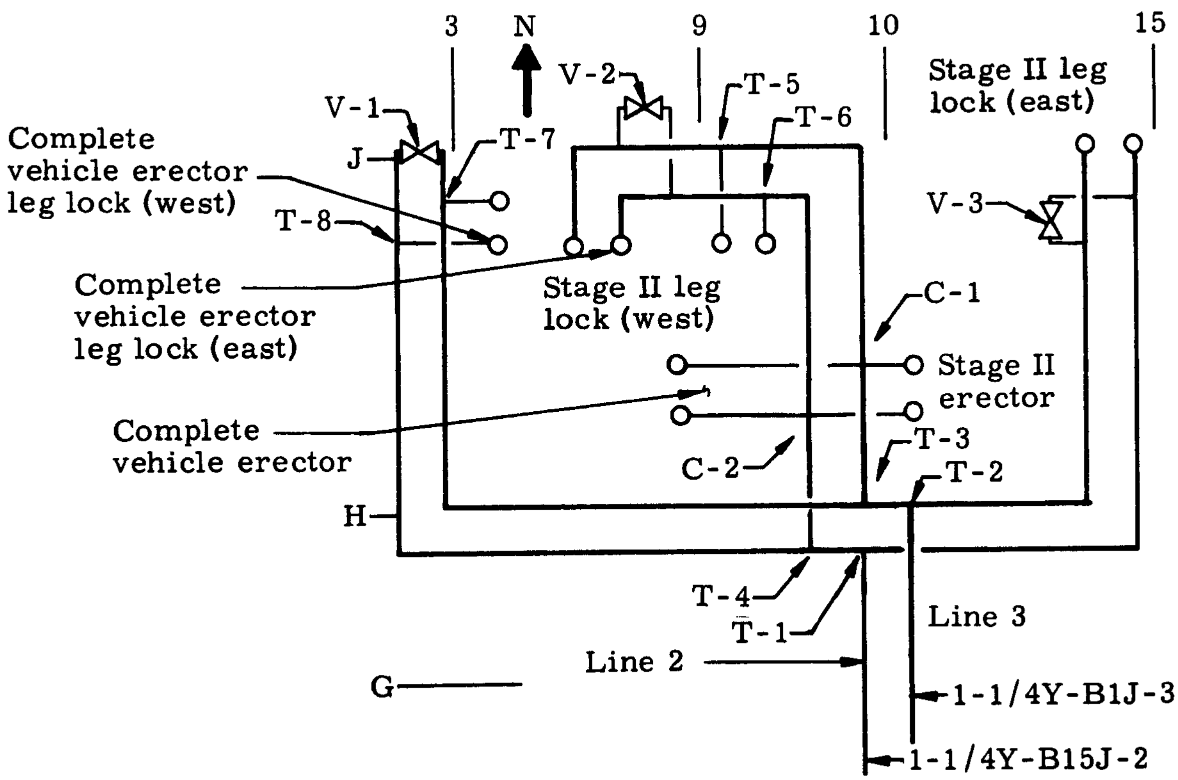


Fig. 7-18. P-19 Test Stand, Hydraulic System, Plumbing Installation (lines 2 and 3 only)

7.4 ELECTRIC POWER SYSTEM INSTALLATION

7.4.1 Description

7.4.1.1 System Functional Description

The Electric Power System (EPS) (Figs. 7-19 and 7-20) basically provides and controls electric power for the Aerospace Ground Equipment (AGE) and for launch vehicle systems prior to launching. The EPS consists of facility and AGE items; however, only the AGE will be considered in this section.

The AGE portion of the EPS provides the means to:

(1) Locally generate essential electric power.

(2) Convert, control, monitor and distribute the electric power necessary for the launch vehicle AGE during normal and essential modes of operation. The normal mode provides power distribution to those EPS elements required to support the complex operations other than Sequential Compatibility Firing (SCF), Flight Readiness Firing (FRF) and launch. The essential mode provides local power generation and distribution to those EPS elements required to support essential complex operations during SCF, FRF and launch.

(3) Control, monitor and check out AGE electric power used by the launch vehicle.

(4) Control, monitor and check out internal power used by the launch vehicle during test operations.

(5) Monitor internal hydraulic power used by the launch vehicle during test operations.

7.4.1.2 Component Description

The equipment used for accomplishing these functions of the EPS is described in two sections--the Power Distribution Control Set (PDCS), (CP 3700), and the AGE Electric Power Supply and Distribution System.

7.4.1.2.1 The PDCS includes the following equipment.

(1) The PDCS console (CP 3780), located on the second floor of the blockhouse, provides monitor displays and controls for initiating control functions.

(2) The PDCS rack (CP 3720), located on the second floor of the blockhouse, contains hold and

kill monitoring circuitry for the AGE and launch vehicle power sources.

(3) The PDCS rack (CP 3730), located in the transfer room of the approach ramp building, contains relays and power contactors for control of 28-v dc electric power for application to the launch vehicle, and termination facilities for transfer of signals to the blockhouse portion of the PDCS.

(4) Transfer switches TSW-1 (facility), TSW-2 (facility), TSW-3 (facility) and TSW-4 (facility), located in the upper equipment room of the approach ramp building, are used to connect the APS and IPS preload, APS and IPS power, and hydraulic pump motor power to either the complete vehicle or the Stage II location (see Table 7.2).

(5) Junction boxes (CP 3730 and CP 3730A) are located in the upper equipment room.

The PDCS performs the following general functions.

(1) Control of the energizing and de-energizing of the launch vehicle AGE electric ground power supplies.

(2) Application and removal of 28-v dc AGE power to and from the launch vehicle Accessory Power System (APS) and Instrumentation Power System (IPS) d-c buses.

(3) Control of the transfer of launch vehicle APS and IPS d-c buses from AGE 28-v dc power to launch vehicle internal airborne battery power.

(4) Monitoring of the availability of facility primary 60-cps electric power sources.

(5) Monitoring of the electric power utilized by the launch vehicle and provision for hold and kill signals to the Master Operations Control System (MOCS) as required.

(6) Provision of launch vehicle bus overvoltage protection.

(7) Monitoring of the positions of the launch vehicle motor-driven switches controlled by the PDCS.

(8) Monitoring of the launch vehicle hydraulic systems and provision of hold and kill signals to the MOCS as required.

(9) Control of the starting and stopping of the launch vehicle electric motor-driven hydraulic pumps.

(10) Monitoring and control of AGE 115-volt, 60-cps power to the launch vehicle APS and IPS battery heaters.

7.4.1.2.2 The AGE Electric Power Supply and Distribution System includes the following equipment (Figs. 7-19 and 7-20):

(1) Equipment to convert facility electric power for AGE use.

(a) Ground power supplies TR-1 through TR-5, 28-v dc, 450-ampere (CP 4795). These units are of the transformer-rectifier type which utilize silicon rectifiers rated for a 440-volt, 60-cps input.

(b) Spare power supply, 28-v dc (CP 4793). In the event of failure of any of the CP 4795 AGE 28-v dc power supplies, this mobile power supply will replace the failed unit.

(c) Precise motor-generator units MG-1, MG-2 and MG-3, 60-cps (CP 2310). Each consisting of a 440-v, 75-hp motor driving a 50-kw, 120/208-v, 60-cps generator. These are used as standby sources of power for 60-cps Ground Instrumentation Equipment (GIE).

(2) Essential electric power generating equipment. A diesel engine-generator set (CP 4501) supplies 277/480-v, 3-phase 4-wire, 60-cps essential power to the complex during checkout and countdown. A control panel is included as part of the generator set.

(3) Associated battery charging and dummy load equipment utilized for checkout and maintenance of the AGE power units.

(a) Portable 28-v dc dummy load (CP 4791). This manually controlled 14-kw dummy load consisting of a trailer, load banks, fans and panel instruments is used to check the overload capability of the 28-v dc power supplies (CP 4795) and to discharge the secondary batteries in the standby battery system (CP 4509).

(b) Mobile, Ni-Cad, 28-v dc battery charger (CP 4505) has an output of 90 amperes from a 440-v, 60-cps input and is used to charge the standby batteries (CP 4509).

(c) An AGE battery charger is provided for conditioning secondary-type silver-zinc flight batteries.

(4) Equipment for distribution of AGE electric power.

(a) The d-c circuit breaker panelboards (14 buses) (CP 9501). Although the d-c circuit breaker panelboards are existing facility equipment, the AGE-facility interface occurs at the inputs to the circuit breakers. Thus, the panelboards and wiring to the circuit breakers are facility items. The circuit breakers and wiring from the circuit breakers are AGE.

(b) The PDCS cordage of the cable set (CP 9501).

(c) Ordnance, battery heater and destruct transfer switches TSW-7, TSW-8 and TSW-12 (not shown in Figs. 7-19 and 7-20).

(d) Various termination racks.

(5) Equipment to provide emergency readiness bus power. The 28-v dc standby battery system (CP 4509) is provided to supply 28-v readiness power to the blockhouse readiness bus, and a second system (CP 4509) is provided to supply 28-volt readiness power to the transfer room

readiness bus. These standby sources are required to enable resetting of the launch vehicle motor-driven switches during shutdown activities in the event of a TR-2 or TR-3 power failure.

(6) Receptacles for distribution of 480-volt, 60-cps and 28-v dc power to AGE items.

7.4.2 Sequence of Events

All equipment called out in the installation instructions is installed by Drawings 424-2151000, 424-2251000 and 424-2152000.

7.4.2.1 PDCS Console Installation

7.4.2.1.1 Install PDCS console (CP 3780) on second floor of blockhouse (Locations 204 and 205).

7.4.2.2 PDCS Rack Installation, Second Floor, Blockhouse

7.4.2.2.1 Install PDCS rack (CP 3720) on second floor of blockhouse (Location 235).

7.4.2.3 PDCS Rack Installation, Upper Equipment Room

7.4.2.3.1 Install PDCS rack (CP 3730) in upper equipment room of the approach ramp building (Location 509).

7.4.2.4 Junction Box Installation (CP 3730)

7.4.2.4.1 Install junction box (CP 3730) in upper equipment room of approach ramp building (Location 502).

7.4.2.5 APS-IPS Junction Box Installation

7.4.2.5.1 Install APS-IPS junction box (CP 3730A) in the upper equipment room of approach ramp building (Location 512).

7.4.2.6 DCA Panel Bus Utilization

7.4.2.6.1 Utilize facility provided DCA panel bus rack in upper equipment room of the approach ramp building (Location 515).

7.4.2.7 Transfer Switch Rack Utilization

7.4.2.7.1 Utilize facility provided transfer switch rack containing TSW-1, TSW-2, TSW-3 and TSW-4 in upper equipment room of the approach ramp building (Location 514).

7.4.2.8 TR-3 Utilization

7.4.2.8.1 Utilize existing TR-3 in upper equipment room (Location 504).

7.4.2.9 TR-4 Utilization

7.4.2.9.1 Utilize existing TR-4 in upper equipment room (Location 505).

7.4.2.10 TR-5 Utilization

7.4.2.10.1 Utilize existing TR-5 in upper equipment room (Location 506).

7.4.2.11 PP2A Patch Rack Installation

7.4.2.11.1 Install patch rack PP2A in transfer room (Location 202).

7.4.2.12 MG-3 Installation

7.4.2.12.1 Install MG-3 in upper equipment room (Location 508).

7.4.2.13 Readiness Battery and Control Box Utilization

7.4.2.13.1 Utilize existing readiness battery and control box (CP 4509) in upper equipment room (Location 503).

7.4.2.14 TSW-2 Installation

7.4.2.14.1 Install TSW-2 in upper equipment room (Location 513).

7.4.2.15 TBL-1 Utilization

7.4.2.15.1 Utilize rack TBL-1 in transfer room (Location 208).

7.4.2.16 TBL-2 Utilization

7.4.2.16.1 Utilize rack TBL-2 in transfer room (Location 214).

7.4.2.17 TBC-1 Utilization

7.4.2.17.1 Utilize rack TBC-1 in transfer room (Location 212).

7.4.2.18 TBC-2 Utilization

7.4.2.18.1 Utilize rack TBC-2 in transfer room (Location 211).

7.4.2.19 DRC-2 Installation

7.4.2.19.1 Install rack DRC-2 in transfer room (Location 204).

7.4.2.20 TBP-1 Utilization

7.4.2.20.1 Utilize rack TBP-1 in transfer room (Location 209).

7.4.2.21 Circuit Breakers Installation

7.4.2.21.1 Install circuit breakers in panel LC-3 in transfer room (Location 304).

7.4.2.22 TSW-11 Utilization

7.4.2.22.1 Utilize facility provided TSW-11 in transfer room (adjacent to LC-3).

7.4.2.23 Circuit Breaker Installation

7.4.2.23.1 Install circuit breakers in panel 1EB in electrical equipment room of approach ramp building (Location 317).

7.4.2.24 Position Indicator Switch Installation, TSW-5

7.4.2.24.1 Install position indicator switch on TSW-5 in electrical equipment room (Location 313).

7.4.2.25 Position Indicator Switch Installation, TSW-6

7.4.2.25.1 Install position indicator switch on TSW-6 in the blockhouse first floor general area (Location 109).

7.4.2.26 TSW-7 Installation

7.4.2.26.1 Install TSW-7 in electrical equipment room (Location 324).

7.4.2.27 TSW-12 Installation

7.4.2.27.1 Install TSW-12 in electrical equipment room (Location adjacent to TSW-7).

7.4.2.28 TSW-8 Installation

7.4.2.28.1 Install TSW-8 in electrical equipment room (Location 323).

7.4.2.29 Circuit Breaker Installation, Panels DC-3 and DC-3-II

7.4.2.29.1 Install circuit breakers in panels DC-3 and DC-3-II in electrical equipment room (Location 326).

7.4.2.30 Circuit Breaker Installation, Panel DC-4

7.4.2.30.1 Install circuit breakers in panel DC-4 in electrical equipment room (Location 325).

7.4.2.31 Circuit Breaker Installation, Panel DC-5

7.4.2.31.1 Install circuit breakers in panel DC-5 in electrical equipment room (Location 327).

7.4.2.32 TR-1 Utilization

7.4.2.32.1 Utilize existing TR-1 in blockhouse first floor general area (Location 16).

7.4.2.33 TR-2 Utilization

7.4.2.33.1 Utilize existing TR-2 in blockhouse first floor general area (Location 17).

7.4.2.34 MG-1 Installation

7.4.2.34.1 Install MG-1 in blockhouse first floor general area (Location 15).

7.4.2.35 MG-2 Installation

7.4.2.35.1 Install MG-2 in blockhouse first floor general area (Location 14).

7.4.2.36 Circuit Breaker Installation, Panel 1EA

7.4.2.36.1 Install circuit breakers in panel 1EA in blockhouse first floor general area (Location 106).

7.4.2.37 Readiness Battery and Control Box Utilization

7.4.2.37.1 Utilize existing readiness battery and control box (CP 4509) in blockhouse first floor general area (Location 13).

7.4.2.38 Circuit Breaker Installation, Panel 2EA

7.4.2.38.1 Install circuit breakers in panel 2EA in blockhouse first floor general area (Location 132).

7.4.2.39 Circuit Breaker Installation, Panel DC-1

7.4.2.39.1 Install circuit breakers in panel DC-1 in blockhouse first floor general area (Location 126).

7.4.2.40 Circuit Breaker Installation, Panel DC-2

7.4.2.40.1 Install circuit breakers in panel DC-2 in blockhouse first floor general area (Location 125).

7.4.2.41 Circuit Breaker Installation, Panel LC-1

7.4.2.41.1 Install circuit breakers in panel LC-1 in blockhouse first floor general area (Location 128).

7.4.2.42 TSW-9 Utilization

7.4.2.42.1 Utilize facility provided TSW-9 in blockhouse first floor general area (adjacent to LC-1).

7.4.2.43 Circuit Breaker Installation, Panel LC-2

7.4.2.43.1 Install circuit breakers in panel LC-2 in blockhouse first floor general area (Location 129).

7.4.2.44 TSW-10 Utilization

7.4.2.44.1 Utilize facility provided TSW-10 in blockhouse first floor general area (adjacent to LC-2).

7.4.2.45 TBL-1 Rack Utilization

7.4.2.45.1 Utilize TBL-1 rack in blockhouse first floor general area (Location 6).

7.4.2.46 TBL-2 Rack Utilization

7.4.2.46.1 Utilize TBL-2 rack in blockhouse first floor general area (Location 7).

7.4.2.47 TBC-1 Rack Utilization

7.4.2.47.1 Utilize TBC-1 rack in blockhouse first floor general area (Location 9).

7.4.2.48 TBC-2 Rack Utilization

7.4.2.48.1 Utilize TBC-2 rack in blockhouse first floor general area (Location 10).

7.4.2.49 TBC-3 Rack Utilization

7.4.2.49.1 Utilize TBC-3 rack in blockhouse first floor general area (Location 11).

7.4.2.50 TBP-1 Rack Utilization

7.4.2.50.1 Utilize TBP-1 rack in blockhouse first floor general area (Location 12).

7.4.2.51 Panel X-023 Installation

7.4.2.51.1 Install panel X-023 in rack (CP 6430) in the blockhouse control room (Location 121).

7.4.2.52 480-Volt Utility Receptacles Installation

7.4.2.52.1 Install three 480-v dc, 60-cps utility receptacles (CP 9501).

7.4.2.53 28-Volt Utility Receptacles Installation

7.4.2.53.1 Install four 28-v dc utility receptacles (CP 9501).

7.4.2.54 Diesel Engine-Generator Set Utilization

7.4.2.54.1 Utilize existing CP 4501 diesel engine-generator set and control panel in blockhouse utility room (Locations 21 and 22).

7.4.2.55 PDCS Cabling Installation

7.4.2.55.1 Install PDCS cabling (CP 9501) according to Drawings 424-9501040, PDCS Cable and Interconnections, and 424-9501041, PDCS Block Cordage Drawings.

7.4.3 Checkout Procedure

The following major items of the EPS are to be tested.

(1) PDCS (CP 3700).

(a) Console (CP 3780).

(b) Rack (CP 3720).

(c) Rack (CP 3730).

(2) Electric Power Supply and Distribution System.

(a) Power transfer switchgear.

(b) Associated AGE power wiring.

(c) Power panel schedules.

(d) Emergency diesel generator set.

(e) 28-v dc ground power supplies.

(f) Motor-generator sets.

(g) Standby battery system.

(h) 28-v dc portable dummy load.

The tests will demonstrate the following functions.

(1) Operation of the circuitry that applies and removes 28-v dc AGE power to and from the launch vehicle APS and IPS d-c buses.

(2) Control of transfer circuitry for launch vehicle APS and IPS d-c buses from AGE 28-v dc power to launch vehicle internal airborne battery power.

(3) Operation of monitors for launch vehicle power.

(4) Hold and kill functions.

(5) Monitors for launch vehicle motor-driven switches controlled by the PDCS.

(6) Launch vehicle hydraulic system monitoring.

(7) Operation of launch vehicle hydraulic system pump circuitry.

(8) Monitoring and control circuitry for APS and IPS battery heaters.

(9) Airborne battery preload capability.

(10) Remote control and monitoring of all transformer rectifiers and motor generators.

(11) Operation of diesel generator and transomatic power transfer monitors.

(12) Monitors for standby battery systems.

(13) That components and equipments comprising the primary power system are of adequate size and rating to safely handle all required loads.

(14) Proper delivery and control of required amounts of 480-v ac, 3-phase and 120/208-v ac, 3-phase power through the motor control switchgear and to the individual load terminations.

(15) Correct automatic operation of the 480-v ac, 3-phase load transfer circuitry.

(16) That ground loops do not exist on the major system ground buses.

(17) Proper control and delivery of 28-v dc power from either the power supplies (CP 4795) or the standby battery system to the 28-v dc distribution panels.

Detailed test procedures are contained in Test Procedure 424-676/AMR and Ground System Test Procedures 424-1038/AMR and 424-1029/AMR.

Table 7-2 presents transfer switches and defines their functions and locations.

TABLE 7-2

Transfer Switch List

Number	Function	Type of Installation	Location	Location No.
TSW-1	Pump transfer	Facility	Upper equipment room	514
TSW-2	IPS-APS preload	AGE	Upper equipment room	513
TSW-3	IPS transfer	Facility	Upper equipment room	514
TSW-4	APS transfer	Facility	Upper equipment room	514
TSW-5	Test stand transfer	Facility	Electrical equipment room	313
TSW-6	Blockhouse transfer	Facility	Blockhouse generator area	109
TSW-7	Ordnance	AGE	Electrical equipment room	324

TABLE 7-2 (continued)

Number	Function	Type of Installation	Location	Location No.
TSW-8	Battery heaters	AGE	Electrical equipment room	323
TSW-9	LC1 transfer	Facility	Blockhouse generator area	Adjacent to LC1
TSW-10	LC2 transfer	Facility	Blockhouse generator area	Adjacent to LC2
TSW-11	LC3 transfer	Facility	Transfer room	Adjacent to LC3
TSW-12	Destruct system	AGE	Electrical equipment room	Adjacent to TSW-7

7.4.4 Documentation

Document No.	Title
424-1000030	Design Criteria, Cable Set, AMR
424-1715013	Design Criteria, AGE Electric Power System, AMR and VTS
424-2050350	Cable Set Installation, AGE
424-2151000	AGE Installations, Blockhouse First Floor, Complex 19
424-2152000	AGE Installations, Launch Deck, Lower Levels, Complex 19
424-2251000	AGE Installations, Blockhouse Second Floor, Complex 19
424-3700100	Power Distribution Control Set
424-9501040	Cable and Interconnections, PDCS

Document No.	Title
424-9501041	Block Cordage, PDCS
424-9501100	Cable Set, AMR
424-676/AMR	Electrical System Countdown Preparation
424-1050/AMR	GSTP, Power Distribution System
424-1029/AMR	GSTP, Preliminary Power Supply

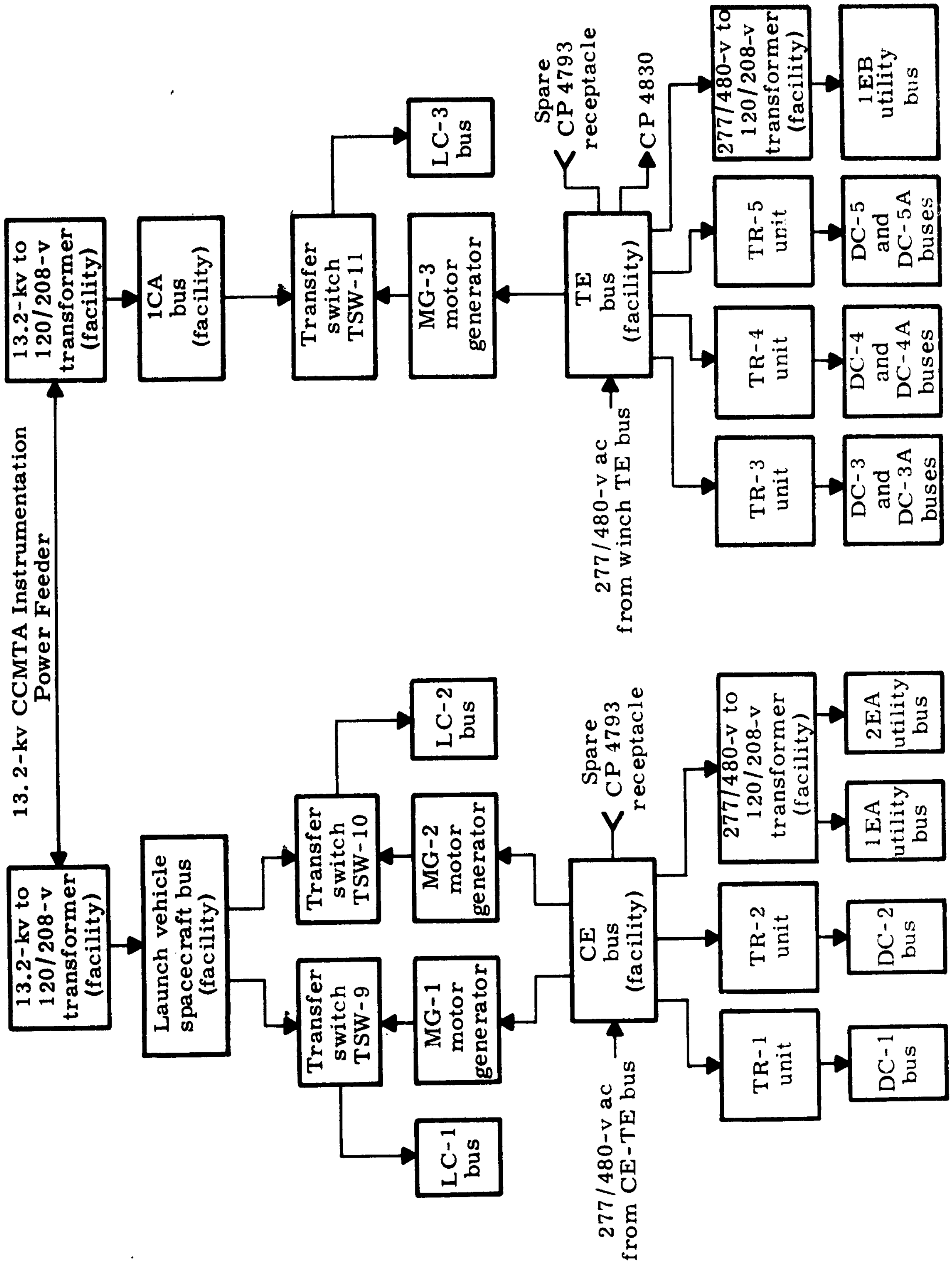


Fig. 7-19. Instrumentation and AGE Power Distribution

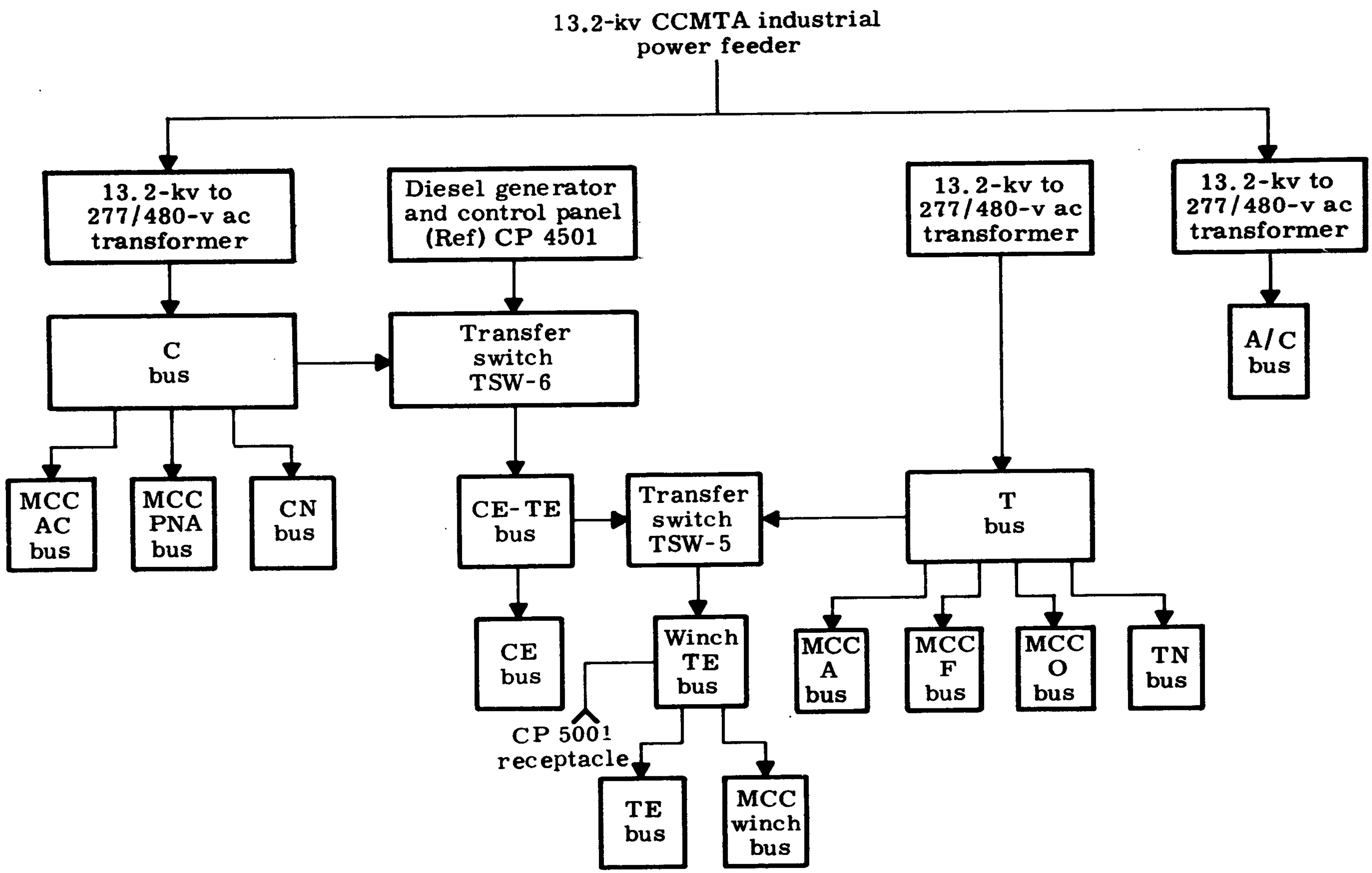


Fig. 7-20. Facility Normal Power Distribution

7.5 PNEUMATIC SYSTEM

7.5.1 Description

The Pneumatic System filters nitrogen gas piped from the offsite facility, regulates pressures and flow rates, and transfers gas to the various components on the complex for pressurizing, purging, blanketing and similar functions.

The three main AGE items in the system are the filter bank (CP 4825), the nitrogen pressure controller (CP 1520), and the pneumatic system plumbing (CP 9154), as shown by Fig. 7-21.

Nitrogen is also piped to other AGE such as the fuel and oxidizer distribution units and transfer control units, and the hydraulic control (C-11) unit.

7.5.2 Sequence of Events

7.5.2.1 Filter Bank Piping Installation (CP 4825)

The filter bank (AGE) is composed of two identical filter systems already located and secured at the site. The nitrogen supply piping AGE/facility interface is located near the floor in the actuator pit (Column G-3). Facility piping carries nitrogen from the off-complex gas compressor building to this AGE/facility interface (Drawing 424-4825000 and Fig. 7-22).

7.5.2.1.1 Connect the filter bank with the facility nitrogen supply lines and with the oxidizer and fuel controller units of the nitrogen pressure controller.

(1) Connect the existing facility supply piping to the K-filters.

(2) Install one 1-1/2-inch line from each of the two filters of the filter bank to the propellant and nitrogen distribution shelter.

7.5.2.2 Nitrogen Pressure Controller Installation (CP 1520)

The nitrogen pressure controller is composed of two units--one for the fuel system control and the other for the oxidizer system control and other AGE components. The controller is a skid mounted console located in the propellant and nitrogen distribution shelter (Drawing 424-1750010). Each unit is connected by separate piping to the filter bank.

7.5.2.2.1 Install the nitrogen controller in the propellant and nitrogen distribution shelter in accordance with Drawing 424-1520000.

7.5.2.3 Nitrogen Distribution Shelter Piping Installation

7.5.2.3.1 Interconnect the nitrogen controller unit with the fuel and oxidizer distributor units and with the filter lines.

(1) Connect the two 1-1/2-inch lines from the filters, one to each of the two units of the nitrogen pressure controller (Fig. 7-23).

(2) Install 1, 1-1/2 and 2-inch lines between both units of the nitrogen controller and the fuel and oxidizer distributor units (Figs. 7-23 to 7-25 identify the piping ports).

(3) Connect a 1-inch line from the cleaning unit port of the oxidizer N_2 controller unit to both the fuel and the oxidizer distributor units (Fig. 7-23).

(4) Cap the cleaning unit port of the fuel N_2 controller unit (Fig. 7-23).

7.5.2.4 Oxidizer Transfer Control N_2 Piping Installation

7.5.2.4.1 Connect the oxidizer N_2 controller with the facility pipeline leading to the oxidizer holding area, and connect the AGE N_2 lines between equipment of the holding area (Fig. 7-26 and Drawing 424-9154150-009).

(1) In the distribution shelter, install a 1-1/2-inch pipe from the oxidizer N_2 controller to the facility pipeline leading to the oxidizer holding area.

(2) In the oxidizer holding area, install a 1-1/2-inch pipe from the oxidizer transfer control unit N_2 inlet port to the facility pipeline leading from the distribution shelter.

(3) Install a 3-inch line from the oxidizer transfer control unit to the oxidizer ready storage tank. Include a line filter in this pipe run.

(4) Install a 1-1/2 inch pipe from the oxidizer transfer control unit to the heat exchanger and circulating units adjacent to the oxidizer ready storage tank.

7.5.2.5 Fuel Transfer Control N_2 Piping Installation

7.5.2.5.1 Connect the fuel N_2 controller with the facility pipeline leading to the fuel holding area, and connect the AGE N_2 lines between equipment of the holding area (Fig. 7-27 and Drawing 424-9154140-009).

(1) In the distribution shelter, install a 1-1/2 inch pipe from the fuel N_2 controller to the facility pipeline leading to the fuel holding area.

(2) In the fuel holding area, install a 1-1/2 inch pipe from the fuel transfer control unit N_2 inlet port to the facility pipeline leading from the distribution shelter.

(3) Install a 3-inch line from the fuel transfer control unit to the fuel ready storage tank. Include a line filter in this pipe run.

(4) Install a 1-1/2 inch pipe from the fuel transfer control unit to the heat exchanger and circulating units adjacent to the fuel ready storage tank.

7.5.2.6 Launch Deck Piping Installation (Drawings 424-9154000 and 424-9154006)

7.5.2.6.1 Install the engine prevalve actuation line, including all fittings and controls, from the nitrogen controller unit to convenient points at the test position and launch position umbilical towers (Figs. 7-28 and 7-29 and Drawing 424-9154110-009).

(1) Install a 1/2-inch line from the engine prevalve actuation port of the nitrogen controller unit to the base of the test position umbilical tower (Fig. 7-23).

(2) Install from this line a 1/2-inch branch line running to the base of the launch position umbilical tower (Figs. 7-28 and 7-29).

7.5.2.6.2 Install the camera purge, complete umbilical junction boxes, spray header actuation and camera floodlight pressurization lines from the oxidizer N_2 controller to the points of utilization at the test and/or launch positions (Figs. 7-26, 7-28, 7-29 and Drawings 424-9154110-009, 424-9154150-009, 424-9154130-009, and 424-9154160-009).

(1) Install a 1-1/2 inch feeder line from the oxidizer N_2 controller, Fig. 7-26, to the launch deck, and run one branch to the test position thrust mount and another branch to the launch position thrust mount.

(2) At the launch position, install a 1-1/2 inch line from the branch feeder line to the umbilical tower.

(3) At the launch position, install a 3/4-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the three cameras in the thrust mount area for purging and pressurization.

(4) At the launch position, install a 1/4-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the pressure switches of the water main and flame bucket water system calibration lines.

(5) At the launch position, install a 1-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the thrust mount area with 1/4-inch takeoffs to the four camera floodlights and also to four diaphragm valves and solenoid valves for actuation of the spray headers.

(6) At the test position, install a 3/4-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the two cameras in the thrust mount area for purging and pressurization.

(7) At the test position, install a 1/4-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the pressure switches of the water main and flame bucket water system calibration lines.

(8) At the test position, install a 1-inch line from the branch line, which was installed per item 1 of paragraph 7.5.2.6.2, to the thrust mount area with 1/4-inch takeoffs to the four camera floodlights and also to four diaphragm valves and solenoid valves for actuation of the spray headers.

7.5.2.6.3 Install the purge set shutdown and cleaning unit quick disconnects and the back pressure reducing regulator lines, including all fittings and controls, from the nitrogen controller to convenient points on the launch deck at the test and launch umbilical towers, and install all associated AGE components (Figs. 7-23, 7-28, 7-29, and Drawings 424-9154110-009, 424-9154130-009, and 424-9154160-009).

(1) Install a 1-inch feeder line from the nitrogen controller cleaning unit port to the base of the test position umbilical tower.

(2) Install a 1-inch branch from this feeder line to the base of the launch position umbilical tower.

(3) At the launch position, install a 1-inch line from the feeder line branch to the shutdown purge set (280450-9 unit) located on the launch deck.

(4) Install a 1/4-inch vent line at the launch position shutdown purge set.

(5) At the launch position, install a 1-inch line from the feeder line branch to the mobile cleaning unit 243856-9 on the launch deck and terminate with a quick disconnect.

(6) Install a 1/4-inch vent line at the launch position mobile cleaning unit.

(7) At the test position, install a 1-inch line from the feeder line to the shutdown purge set 280450-9 on the launch deck and terminate with a quick disconnect.

(8) Install a 1/4-inch vent line at the test position mobile cleaning unit.

7.5.2.6.4 Install the spacecraft nitrogen supply line (Fig. 7-29 and Drawings 424-9154110-009, 424-9154130-009).

(1) Install a 3/8-inch line from the filter bank to the base of the launch position umbilical tower (Figs. 7-23 and 7-29).

7.5.2.7 Launch Position Umbilical Tower Piping Installation (Drawings 424-9154000, 424-9154006, 424-9154130 and Fig. 7-29)

7.5.2.7.1 Install five lines in the launch position umbilical tower from the launch deck piping interfaces at the base of the tower.

(1) From the 1-1/2-inch branch line (item 2 of paragraph 7.5.2.6.2) install a 3/4-inch line up the launch position umbilical tower to the three camera stations for purging and to a quick disconnect at the AGE/spacecraft interface.

(2) From the 1-1/2-inch branch line (item 2 of paragraph 7.5.2.6.2), install a 1/2-inch line up the launch position umbilical tower to the four complete umbilical junction boxes. At each junction box, include a hand valve and an orifice in the line.

(3) For the spacecraft nitrogen supply, install a 3/8-inch line, from the interface (item 1 of paragraph 7.5.2.6.4) up the umbilical tower to the AGE/spacecraft interface.

(4) Install a 1-inch line, for the back pressure reducing regulators, from the interface (item 2 of paragraph 7.5.2.6.3) up the umbilical tower and connect to the four emergency relief valves.

(5) Install a prevalve accumulator as close as possible to the launch vehicle Stage I engines and connect to the feeder line (paragraph 7.5.2.6.1) at the base of the launch position umbilical tower.

(6) Install a 1/2-inch tube from the Stage I prevalve accumulator to the launch vehicle Stage I interface connection and connect a pressure switch to this line.

7.5.2.8 Test Position Umbilical Tower Piping Installation (Drawings 424-9154000, 424-9154006, 424-9154160 and Fig. 7-28)

7.5.2.8.1 Install three lines in the test position umbilical tower from the launch deck piping interfaces at the base of the tower.

(1) From the 1-1/2-inch branch line (item 1 of paragraph 7.5.2.6.2), install a 1/2-inch line up the test position umbilical tower to the two junction boxes. Include at each junction box a hand valve and an orifice in the line.

(2) Install a 1-inch line, for the back pressure reducing regulators, from the interface (item 1 of paragraph 7.5.2.6.3) up the umbilical tower and connect to the two emergency relief valves.

(3) Install a prevalve accumulator as close as possible to the launch vehicle Stage II engine and connect to the feeder line (paragraph 7.5.2.6.1) at the base of the test position umbilical tower.

(4) Install a 1/2-inch tube from the Stage II prevalve accumulator to the launch vehicle Stage II interface connection, and connect a pressure switch to this line.

7.5.3 Checkout Procedure

The identical procedure is used for checkout of the Pneumatic System, and PTPS. Refer to Ground Systems Test Procedure 424-1033/AMR.

7.5.4 Documentation

Document No.	Title Pneumatic System
424-9154000	Piping Installation
424-9154110	Piping, Launch Pad
424-9154140	Piping, Fuel Storage Area
424-9154150	Piping, Oxidizer Storage Area

Document No.	
	Pneumatic System
424-9154130	Piping, Umbilical Tower Launch
424-9154160	Piping, Umbilical Tower Test
424-9154006	Piping Schematic
424-9550006	Schematic Propellant Transfer and Pressurization System Dual Loading
ER 12053A	Launch Complex Facility Design Criteria for Gemini
424-9154005	Design Specification
424-9154008	Test Specification
	Launch Pad Area
424-4825000	Filter Bank Installation
424-1520000	Nitrogen Controller Installation
424-1592000	Oxidizer Distribution Unit Installation
424-1592010	Oxidizer Distribution Unit Assembly
424-1592006	Schematic Oxidizer Distribution Unit
424-1591000	Fuel Distribution Unit Installation
424-1591010	Fuel Distribution Unit Assembly
	Oxidizer Holding Area
424-1514000	Transfer Control Unit Installation
424-1514010	Transfer Control Unit Assembly
424-1516000	Ready Storage Tank
424-1594000	Heat Exchanger and Circulating Units Installation
424-1594010	Heat Exchanger and Circulating Units Assembly
PS 480200003	Propellant Ready Storage Vessel, 20,000-gallon Capacity

Fuel Holding Area

424-1515000	Transfer Control Unit Installation
424-1515010	Transfer Control Unit Assembly
424-1517000	Ready Storage Tank
424-1593000	Heat Exchanger and Circulating Units Installation
424-1593010	Heat Exchanger and Circulating Units Assembly
424-1554000	Fuel Vapor Disposal Unit
424-9551000	Fuel Transfer Piping System
424-9154010	Prevalve Accumulator

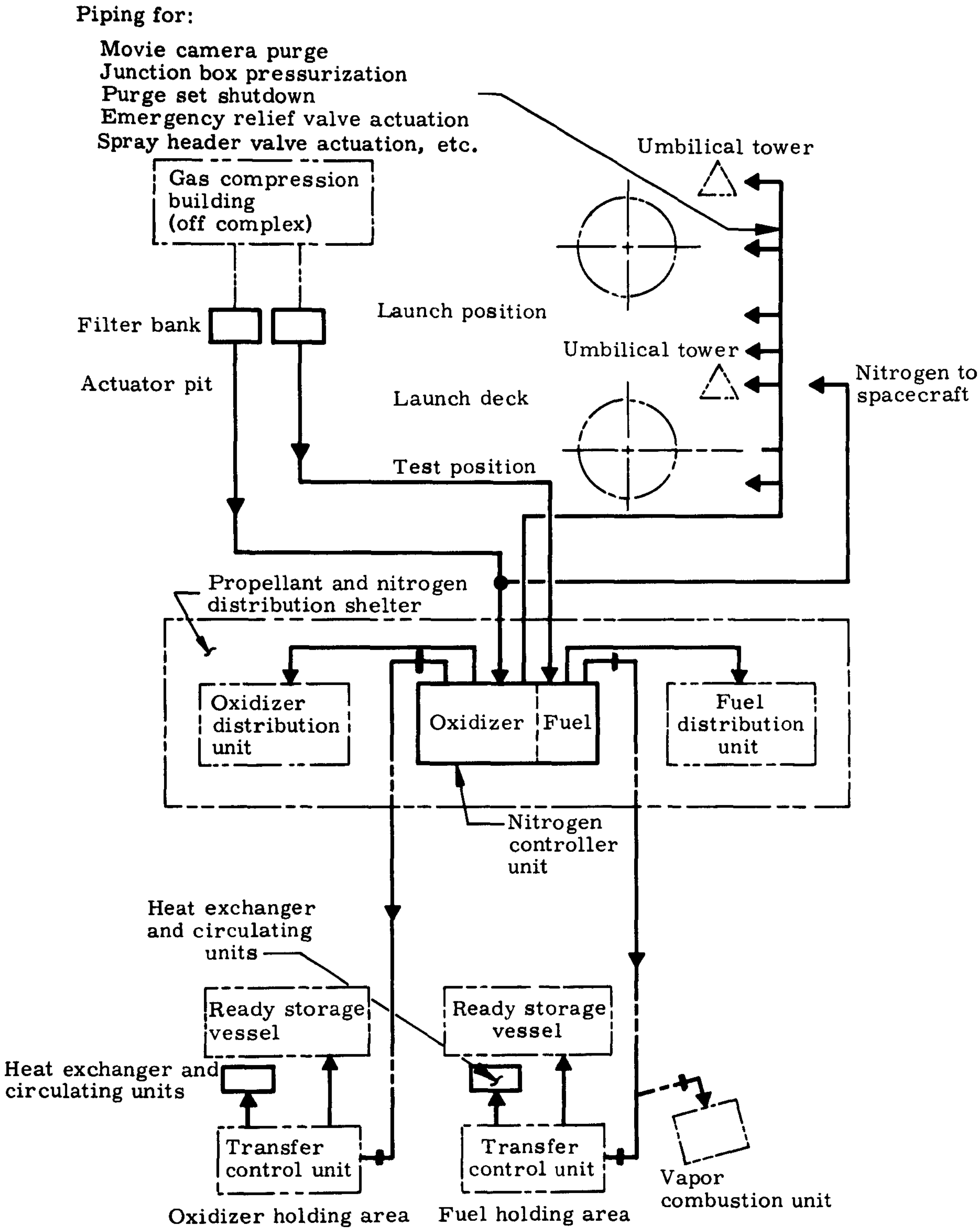


Fig. 7-21. Pneumatic System

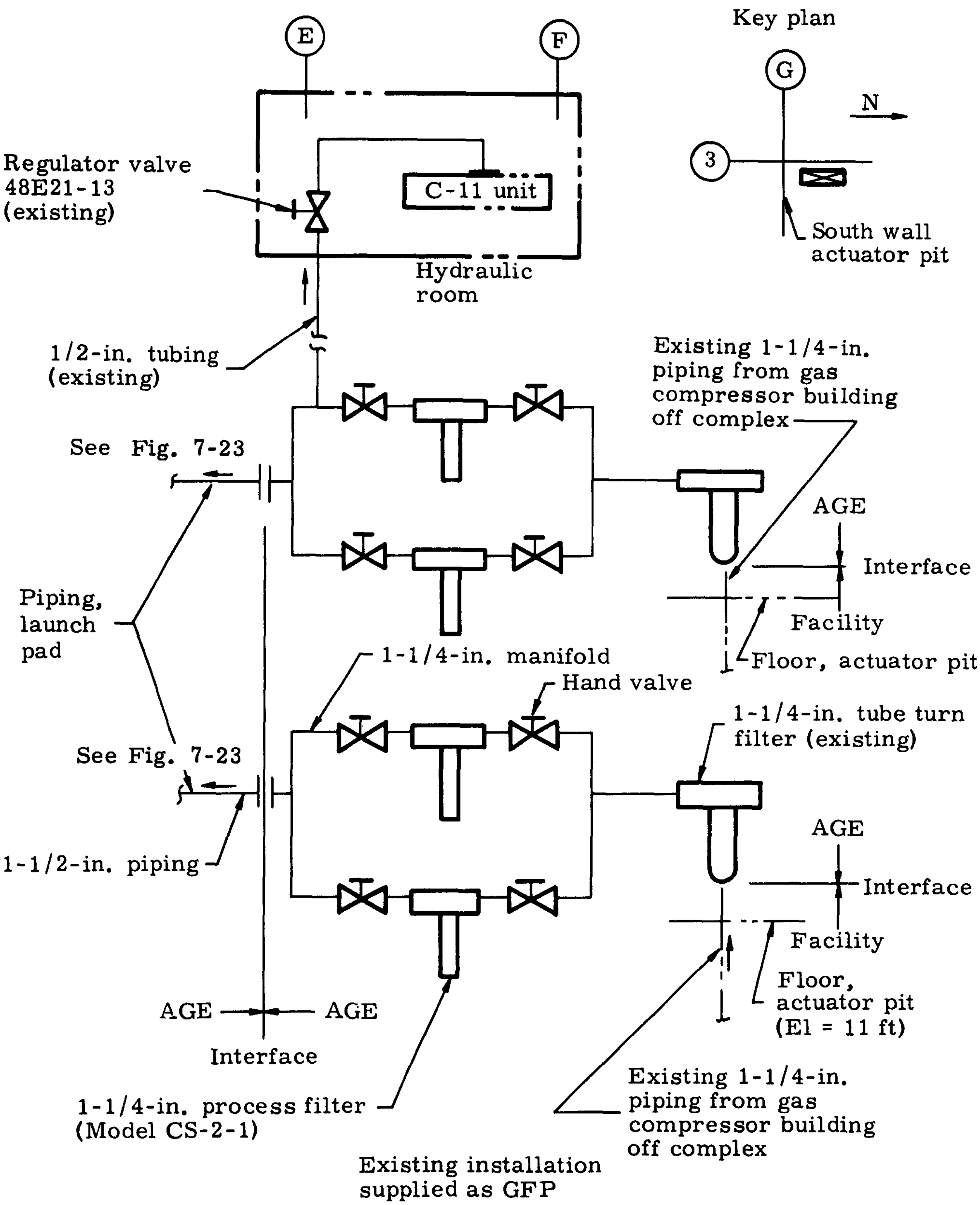


Fig. 7-22. Filter Bank Pneumatic System

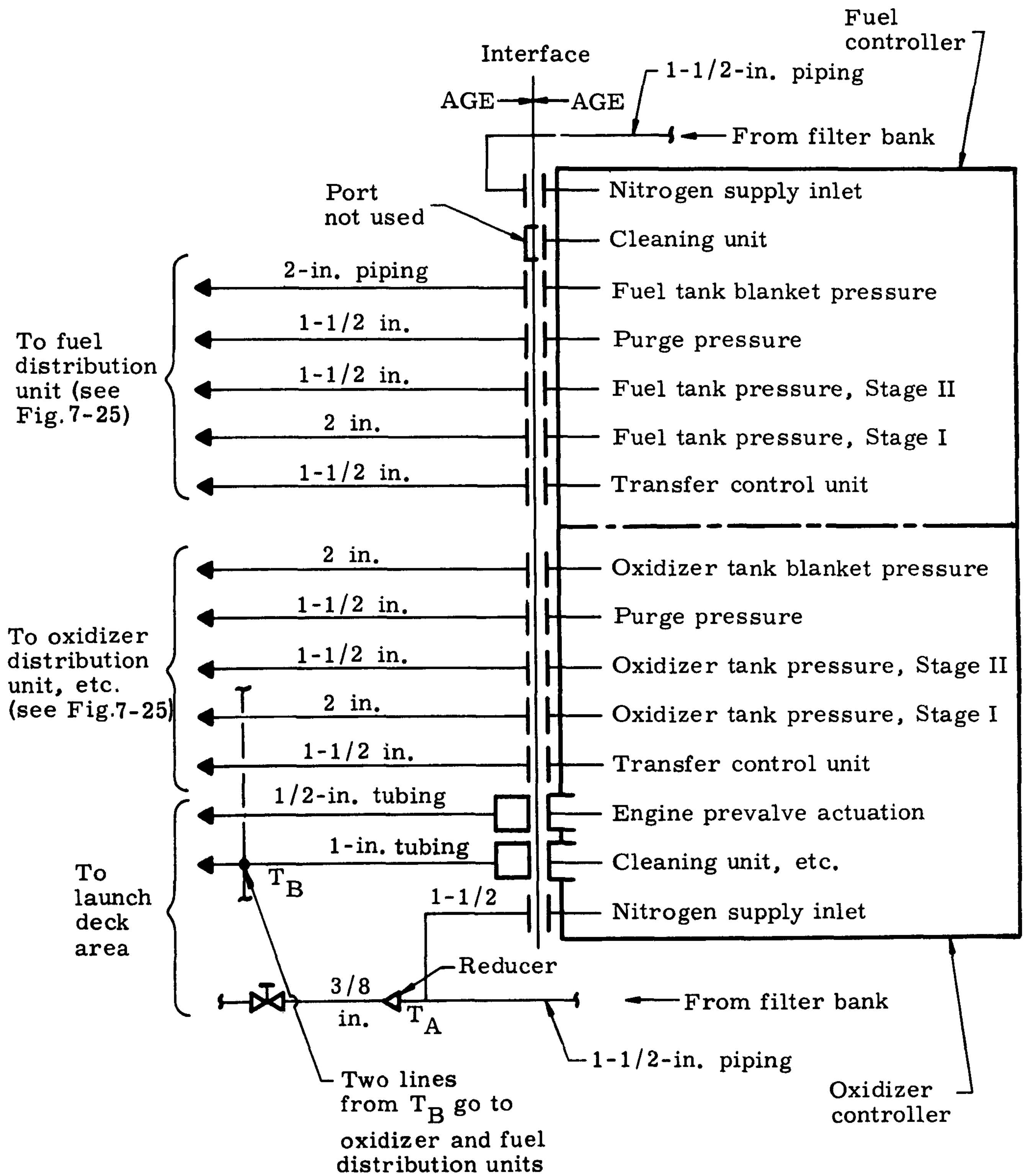


Fig. 7-23. Nitrogen Distribution Shelter Piping Installation

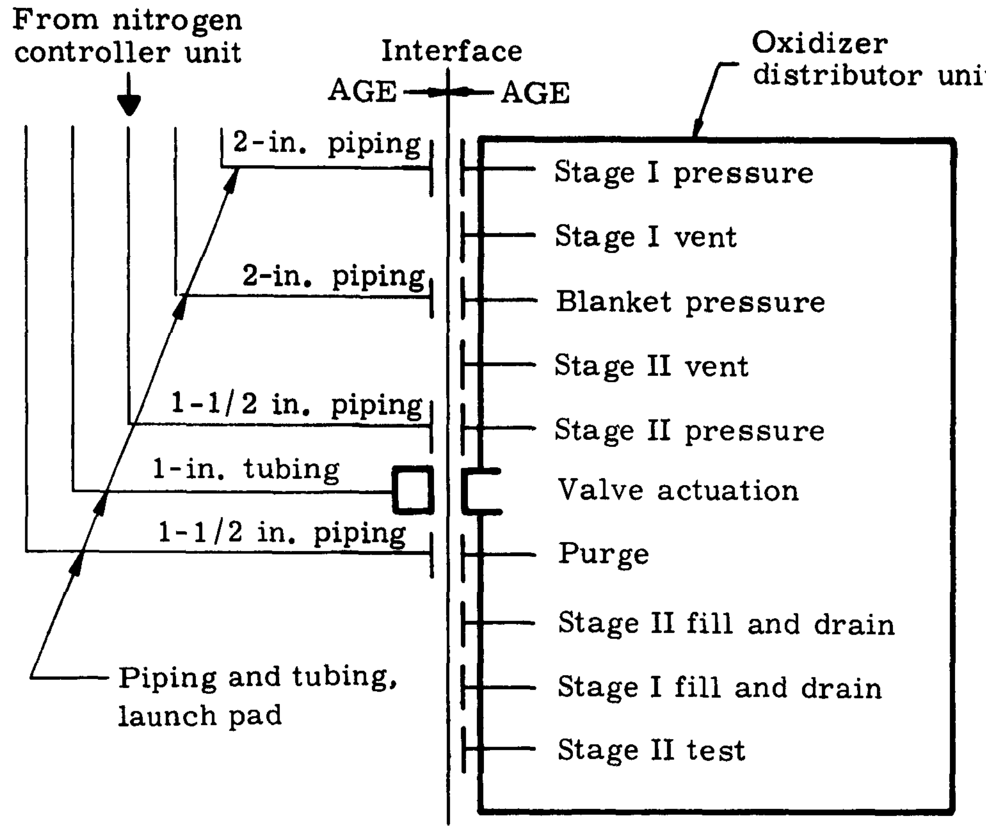


Fig. 7-24 . Oxidizer Distributor Unit Piping

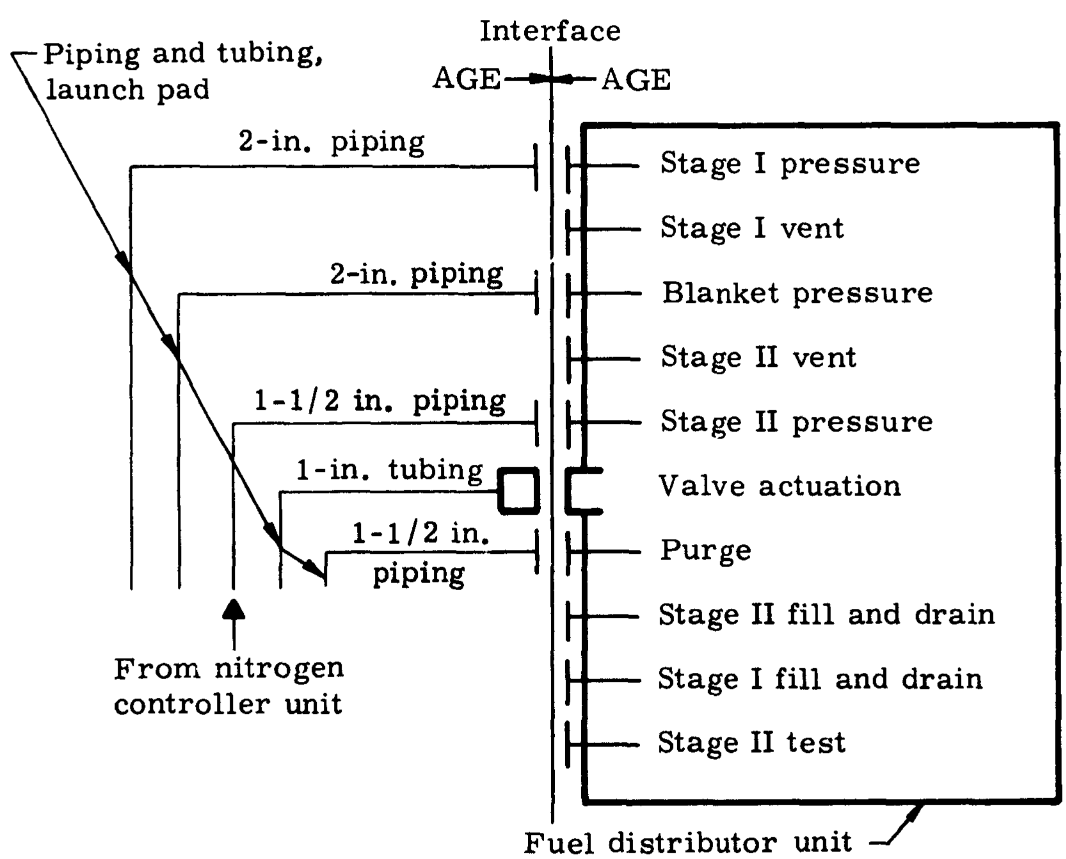


Fig. 7-25. Fuel Distributor Unit Piping

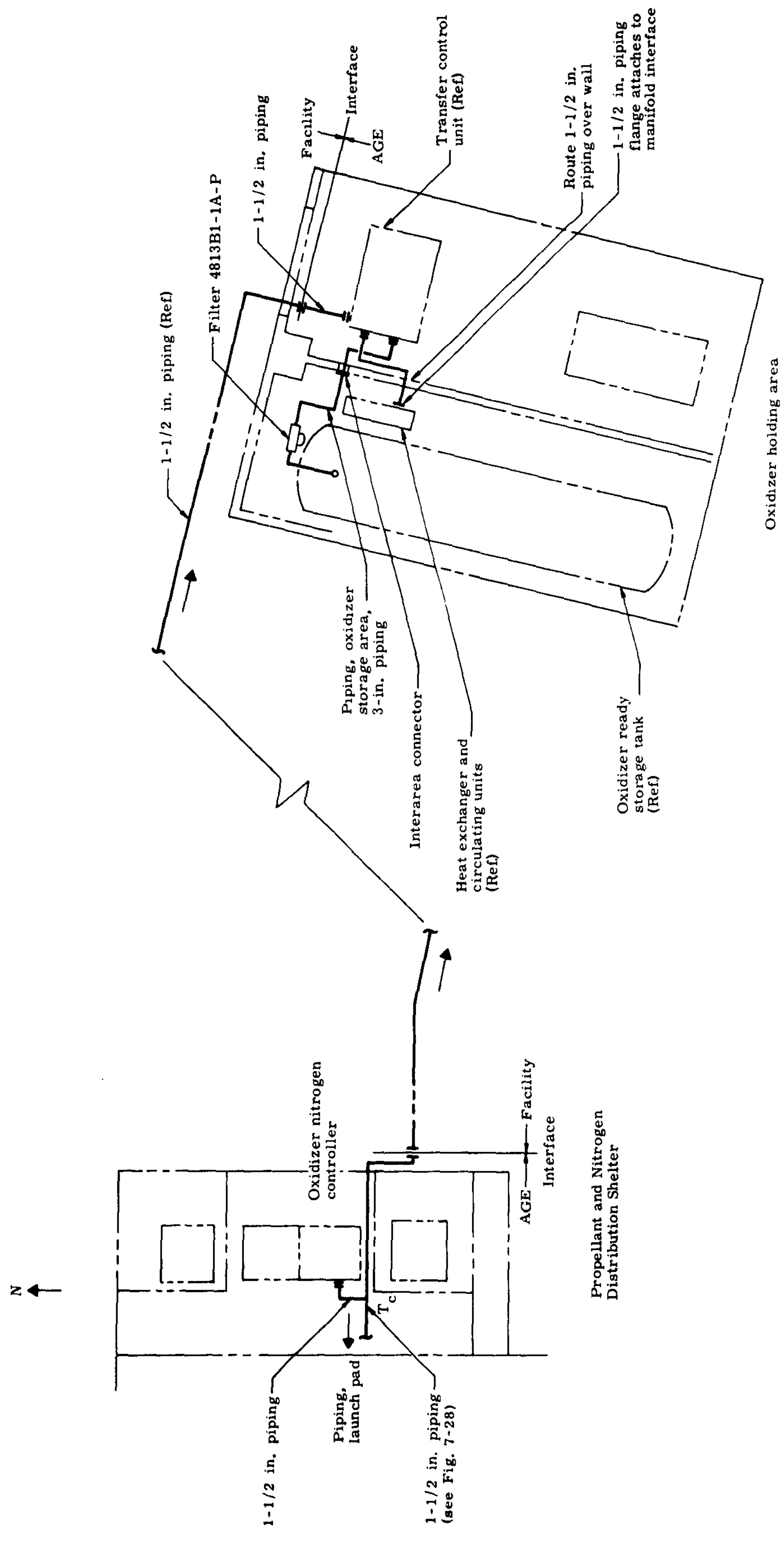


Fig. 7-26. Oxidizer Transfer Control N_2 Piping Installation

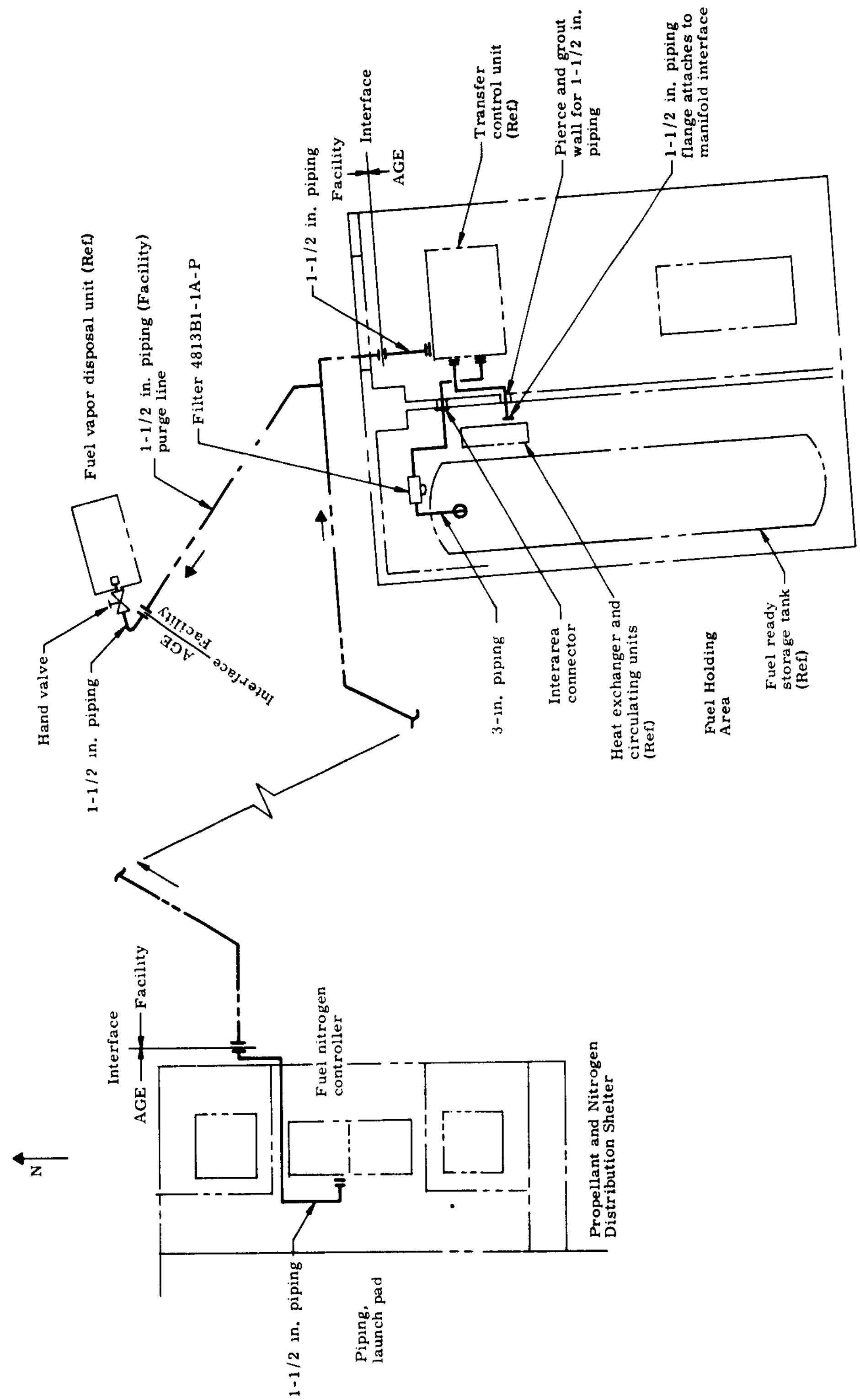


Fig. 7-27. Pressurization Piping for Fuel Transfer Control

LEGEND
1. Engine deluge valve actuation--
   diaphragm valve 4772B2
   solenoid valve 4700B2
   (existing and GFP)
2. Camera illumination--floodlight connection
3. Movie camera
4. Hand valve 4739B2E16T-6P regulator valve
5. Hand valve 4739B2E12T-6P regulator valve
6. 36- and 18-in. water mains and flame bucket water pressure switch calibration lines
7. Hand valve
8. Prevalve accumulator
9. Back pressure reducing regulator
10. Hand valve, 0.016 orifice, J-box fitting
11. Quick disconnect to Aerojet-General shutdown purge set 280450-9
    Hand valve 4739B2E16T-30P
    Hand valve 4739B5S4TGT-15P
12. Pressure switch
13. Hand valve 4739B2E12T-8P

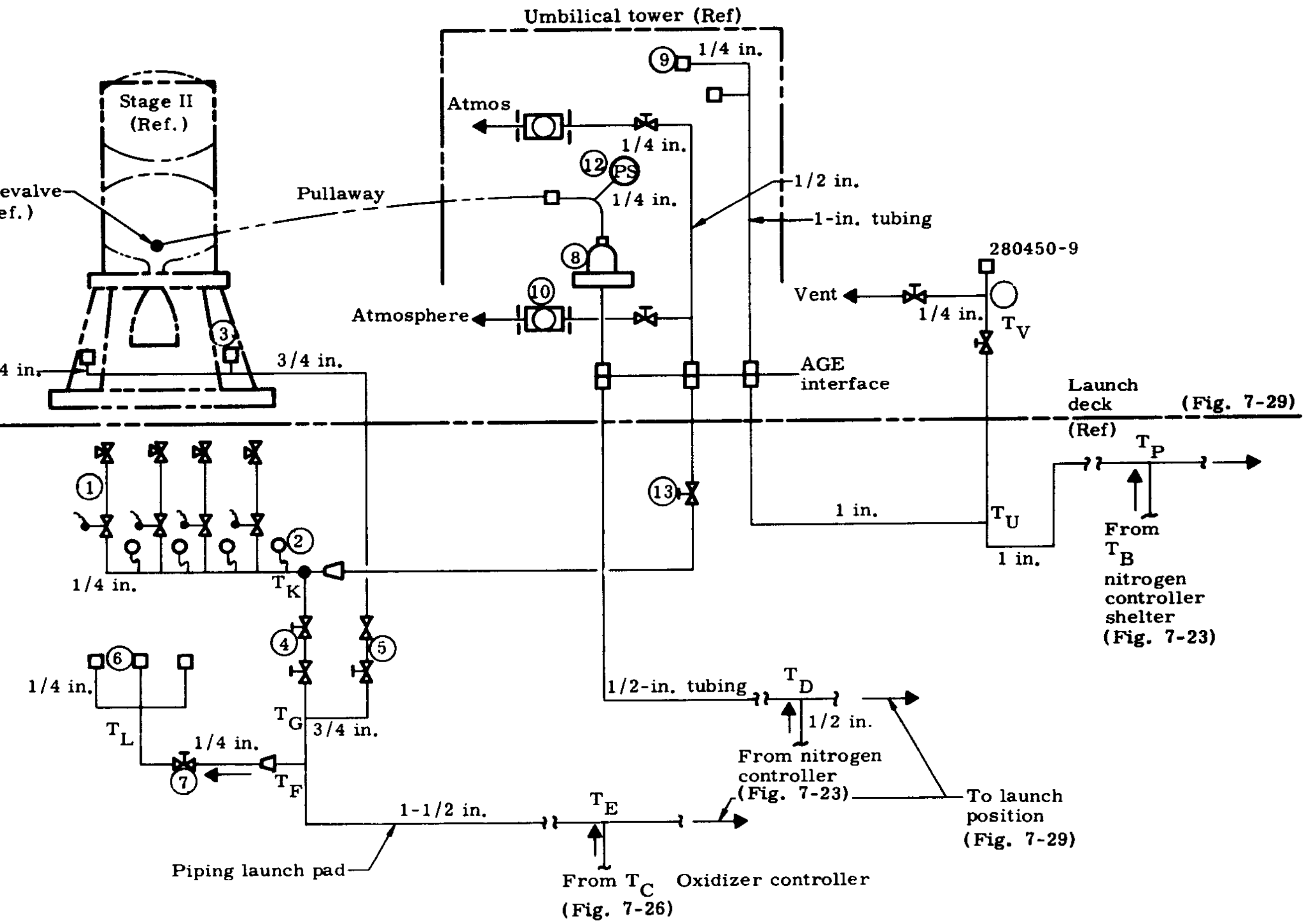
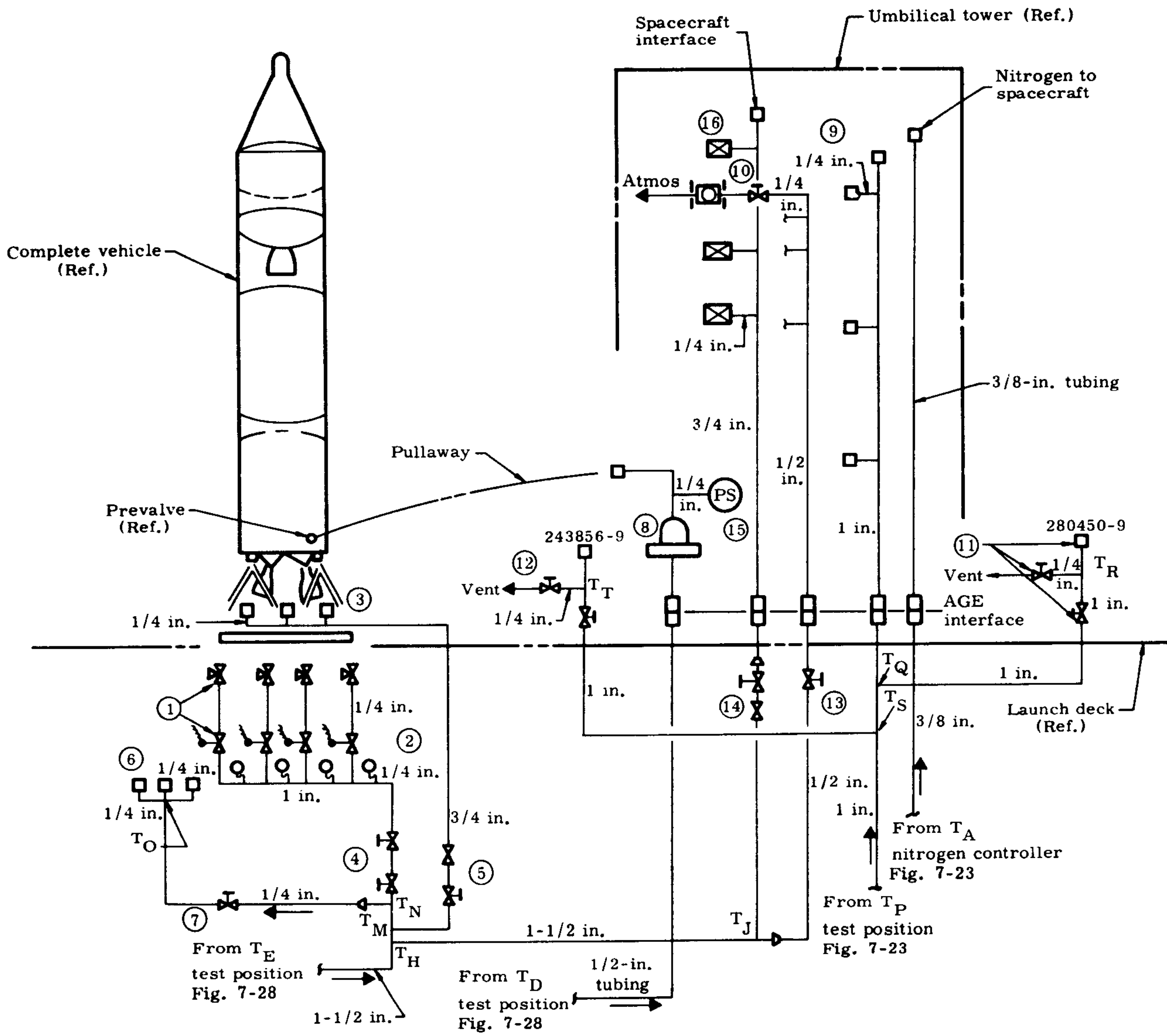


Fig. 7-28. Test Position Nitrogen Piping



LEGEND:

1. Engine deluge valve actuation diaphragm valve 4772B2 (424-4702000) Solenoid valve 4700B2 (existing and GFP)
2. Camera illumination--floodlight connection
3. Movie camera
4. Hand valve 4739B2E16T-6P regulator valve
5. Hand valve 4739B2E12T-6P regulator valve
6. Water mains and flame bucket water pressure switch calibration lines
7. Hand valve
8. Prevalve accumulator 424-9154010
9. Back pressure reducing regulator
10. Hand valve, 0.016 orifice, junction box fitting
11. Aerojet General shutdown purge set 280450-9
    Hand valve 4739B2E16T-30P
    Hand valve 4739B5S4TGT15P
12. Quick disconnect to Aerojet General cleaning unit, 243856-9
    Hand valve 4739B2E16T-30P
    Hand valve 4739B5S4TGT15P
13. Hand valve, CUB 4739B2E12T-8P
14. Hand valve, camera purge line 4739B2E12T-6P
    Regulator
    Reducer
15. Pressure switc'
16. Movie camera

Fig. 7-29. Launch Position Nitrogen Piping

7.6 LAUNCH VEHICLE AIR-CONDITIONING SYSTEM INSTALLATION (CP 4590 and CP 9158)

7.6.1 Description

The Air-Conditioning System (Fig. 7-30) consists of an air-conditioning unit, associated piping, control valves and sensor instrumentation.

The air-conditioning unit is a self-contained, skid-mounted unit. It contains two high temperature compressors utilizing Freon 12 refrigerant. The compressor discharges into a condenser having an intermediate and a final stage. The condenser is cooled by four propeller fans. This is followed by an evaporator in the airstream of a high speed blower. Two venturis in the discharge side of the unit, each having an airflow sensor, together with a small motor-driven compressor, servo valves and damper valves, constitute the airflow control system. The discharge air temperature is controlled by a mercury thermostat which regulates the liquid solenoid operation, thus indirectly controlling operation of the compressors. The control panel is equipped with indicating instruments showing oil and refrigerant pressures and temperatures as well as discharge air volume, flow and temperature.

The associated piping is aluminum and is wrapped with heavy duty insulation. The piping carries conditioned air from the air-conditioning unit to launch vehicle Compartments 2 and 3. The conditioned air flows through piping to the launch vehicle interfaces. Manual control valves located in the piping permit control of airflow to Stage II on the test stand and in the launch position. When Stage II is in the launch position, conditioned air is supplied to Compartments 2 and 3. When Stage II is located on the test stand for sequenced compatibility firings, conditioned air is supplied to Compartment 2 only. A diverter shutoff valve directs the conditioned air to the desired location.

The electrical reheating unit is located in the piping adjacent to the air-conditioning unit and is controlled by two thermostats. Located in the rigid piping are instrumentation sensors which produce an indication on strip chart recorders in the blockhouse.

7.6.2 Sequence of Events

7.6.2.1 Component Inspection

7.6.2.1.1 Leak and pressure test all sections of pipe before installation. No leakage of pressure for five minutes is permitted.

7.6.2.2 Piping Installation from Air-Conditioning Unit to Umbilical Towers

7.6.2.2.1 Install the sections of piping in accordance with the installation drawings.

(1) Fabricate electric heater and diverter shutoff valve transitions in accordance with 424-9158110.

(2) Fabricate pipe supports and clamps in accordance with Drawing 424-9158110.

(3) Fabricate insulation straps and butyl rubber gaskets in accordance with Drawing 424-9158110.

(4) Fabricate panel board box in accordance with 424-9158110.

(5) Fabricate diverter shutoff valve in accordance with Drawing 424-9158110.

(6) Install all pipe supports and clamps in accordance with Drawing 424-9158110.

(7) Install a section of 12-inch pipe, containing a 90° elbow and threadolets for pitot tube and temperature gage, between the roof of the walkthrough cableway and the north side of the air-conditioning unit (Fig. 7-32).

(8) Install a section of 12-inch pipe containing two couplings for thermostats and a 90-degree elbow between the north end of the air-conditioning unit and the centerline of the output orifice.

(9) Install flexible duct between 90-degree elbow and electric heater transition.

(10) Install electric heater and two transitions between the flex-duct and the output orifice.

(11) Install 12-inch pipe between the 90-degree elbow and a line from the outside end of the walkthrough cableway.

(12) Install 12-inch pipe containing two twisted 90-degree (approximate) elbow joints. (Detail A of Fig. 7-32.)

(13) Install and field-fit section of 12-inch pipe containing a 45-degree elbow to the 90-degree twisted elbow joints.

(14) Install 32-foot section of 12-inch pipe between 45-degree elbow joint and a line between Stations F and G along the lower side of the launch deck (Fig. 7-33).

(15) Install a section of 12-inch pipe containing two 45-degree elbows between the end of 32-foot section and Station G along the lower side of the launch deck.

(16) Install a section of 12-inch pipe between Station G and pipe support at Station J.

(17) Install a section of 12-inch pipe containing a 45-degree elbow joint and a transition between Station J and bottom of launch umbilical tower (south side).

(18) Install diverter shutoff valve and diverter valve control rod.

(19) Install an elbow between diverter shutoff valve and launch umbilical tower launch deck interface.

(20) Install rectangular to 8-inch diameter transition.

(21) Install 8-inch butterfly shutoff valve to the transition (Fig. 7-34).

(22) Install a section of 8-inch pipe containing a 45-degree elbow to the butterfly shutoff valve.

(23) Install a section of 8-inch pipe containing two 45-degree elbows between 5-foot 2-inch section and Station 6 under the launch deck.

(24) Install a section of 8-inch pipe between Stations 6 and 9 under the test umbilical tower.

(25) Install section of 8-inch pipe containing a 90-degree elbow at the test umbilical tower interface.

7.6.2.3 Piping Installation on Launch Umbilical Tower

7.6.2.3.1 Install the sections of piping in accordance with Drawing 424-9158130, Piping Installation.

(1) Fabricate pipe clamp supports in accordance with Drawing 424-9158130.

(2) Install pipe supports and clamps in accordance with 424-9158130.

(3) Install sections of 12-inch pipe from launch deck interface to 98-foot 8-inch level on the launch umbilical tower (Fig. 7-35).

(4) Install a section of pipe containing two 12- to 8-inch transitions between 98-foot 8-inch and 107-foot 11-inch levels.

(5) Install butterfly shutoff valve to pipe at 106-foot 4-inch level of the launch umbilical tower (Fig. 7-36).

(6) Install a section of 8-inch pipe containing a 44-degree elbow between butterfly shutoff valve and end of umbilical tower boom No. 3 (Fig. 7-36).

(7) Install fabricated section of 8-inch pipe containing a pitot threadolet and a thermocouple threadolet to the 44-degree elbow joint.

(8) Install butterfly shutoff valve to the 8-inch transition at the 108-foot level (Fig. 7-37).

(9) Install section of 8-inch pipe between butterfly shutoff valve and 115-foot 2-inch level (section contains a 90-degree elbow).

(10) Install a section of 8-inch pipe containing a 39-degree elbow, a thermometer threadolet, and a pipe plug coupling for a thermostat between the 90-degree elbow and the end of launch umbilical tower boom No. 4.

(11) Install an 8-inch pipe containing a pitot tube threadolet to the 39-degree elbow joint.

(12) Install a section of 8-inch pipe containing a pipe plug coupling for a thermostat, a 39-degree elbow joint, a threadolet for a thermocouple, and a 90-degree elbow joint to the 8-foot 6-inch section.

7.6.2.4 Piping Installation on Test Umbilical Tower

7.6.2.4.1 Install the sections of piping in accordance with Drawing 424-9158160, Piping Installation.

(1) Fabricate pipe clamp supports in accordance with Drawing 424-9158160.

(2) Install pipe clamp supports and clamps in accordance with Drawing 424-9158160.

(3) Install 8-inch pipe containing a 45-degree elbow joint between the launch deck interface and the test umbilical tower 31-foot 5-inch level (Fig. 7-38).

(4) Install a section of 8-inch pipe containing a 45-degree elbow between the 31-foot 5-inch and the 35-foot levels.

(5) Install 8-inch pipe containing a 45-degree and a 90-degree elbow between the 35-foot level and the 53-foot 6-inch level.

(6) Install 90-degree elbow at 53-foot 6-inch level.

(7) Install a section of 8-inch pipe to the 90-degree elbow joint along the inside of test umbilical tower boom No. 6. This section contains a 15-degree elbow joint, threadolet for a thermometer, pitot tube threadolet, threadolet for a thermocouple, coupling for a thermostat, and a 45-degree elbow turned down over the end of the boom (Fig. 7-39).

7.6.2.5 Air-Conditioning Unit Installation (CP 4590)

7.6.2.5.1 Install air-conditioning unit in accordance with Drawing 424-2052000.

The air-conditioning unit has been modified in accordance with Drawing 424-4950000. Included in the modifications of the unit are deactivation of the steam reheating system, rewiring the system to control the two high temperature compressors indirectly by thermostats, the addition of a change-over switch to control the action of the two sets of thermostats, and the discontinued use of the low temperature compressor.

7.6.2.5.2 Install the power and control panel in accordance with Drawing 424-2052000 (Fig. 7-31).

7.6.2.5.3 Install the interconnecting cabling between the thermostats on launch umbilical tower boom No. 4 piping and the power and control panel in accordance with Drawings 424-9501410 and 424-9501411 (Fig. 7-31).

7.6.2.5.4 Install interconnecting cabling between the thermostats on test umbilical tower boom No. 6 and the power control panel in accordance with Fig. 7-31.

7.6.2.5.5 Install the power cables from the power and control panel to the electric reheating unit in accordance with Drawings 424-9501410 and 424-9501411 (Fig. 7-31.

7.6.2.5.6 Install interconnecting power cabling from the facility power source to the air-conditioning unit and the power and control panel.

7.6.2.5.7 Install panel board box under the air-conditioning enclosure in accordance with Drawing 424-9158110 (Fig. 7-40).

7.6.2.6 Description of Final Installations

The following procedures shall be followed upon successful completion of Ground System Test Procedure 424-1037/AMR.

7.6.2.7.1 Remove pressure sealing caps from all connections.

7.6.2.7.2 Install insulation around the 8- and 12-inch piping.

7.6.2.7.3 Wrap insulation with fiber glass cloth; then seal with vapor sealer to ensure a good bond of insulation to piping.

7.6.2.7.4 Install aluminum strapping around insulation joints.

7.6.2.7.5 Coat each insulation joint and each section of pipe with mastic sealing compound.

7.6.2.7.6 Install flexible piping on the end of rigid piping to booms Nos. 2 and 3 located on the launch umbilical tower and boom No. 6 on the test umbilical tower (Figs. 7-36, 7-37 and 7-39).

7.6.2.7.7 Install quick-disconnect units on the end of the flexible ducts. Connect lanyards from quick-disconnect units to the umbilical towers.

7.6.3 Checkout Procedure

After the complete air-conditioning system has been installed, perform pressure, leak and flow tests in accordance with Ground System Test Procedure 424-1037/AMR, Air-Conditioning Unit, Launch Vehicle. Described below are principal procedures.

7.6.3.1 Inspection

7.6.3.1.1 Visually inspect the air-conditioning unit and piping for possible damage to the refrigeration or electrical components, loose or damaged clamps, butterfly shutoff valves and shafts, manometer, pitot tubes, temperature gages and connections and thermostats and connections.

7.6.3.2 Preoperation Procedures

7.6.3.2.1 Cycle the compressors (five seconds on and one minute off) several times subsequent to crankcase heater operation to prevent the oil in the crankcase from flashing and forcing oil into freon circuit.

7.6.3.2.2 Ensure that the air-conditioner master circuit breaker is open, all refrigerant valves are open and all switches on the control panel are off. Check for proper oil level in the compressors, and for proper level of refrigerant in the receiver.

7.6.3.2.3 Turn power on for one hour prior to starting air-conditioning unit.

7.6.3.3 Operational Tests and Adjustments

7.6.3.3.1 Adjust air flow on the launch umbilical tower piping.

7.6.3.3.2 Adjust air flow on the test umbilical tower piping.

7.6.3.3.3 Adjust temperature control thermostats on the launch umbilical tower units.

7.6.3.3.4 Adjust temperature control thermostats on the test umbilical tower units.

7.6.3.3.5 Test heater thermal cutout.

7.6.3.3.6 Perform shutdown procedures.

7.6.4 Documentation

Drawing No.	Title
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-9158000	Air-Conditioning System Installation, Gemini Launch Vehicle
424-9158110	Piping, Launch Pad, Air-Conditioning System
424-9158130	Piping, Umbilical Tower, Launch, Air-Conditioning System
424-9158160	Piping, Umbilical Tower, Test, Air-Conditioning System
424-9501410	Interconnections and Cabling, Vehicle Air Conditioner (AGE)
424-9501411	Cordage, Vehicle Air Conditioner (AGE)
424-1037/AMR	Ground System Test Procedure, Air-Conditioning Unit, Launch Vehicle

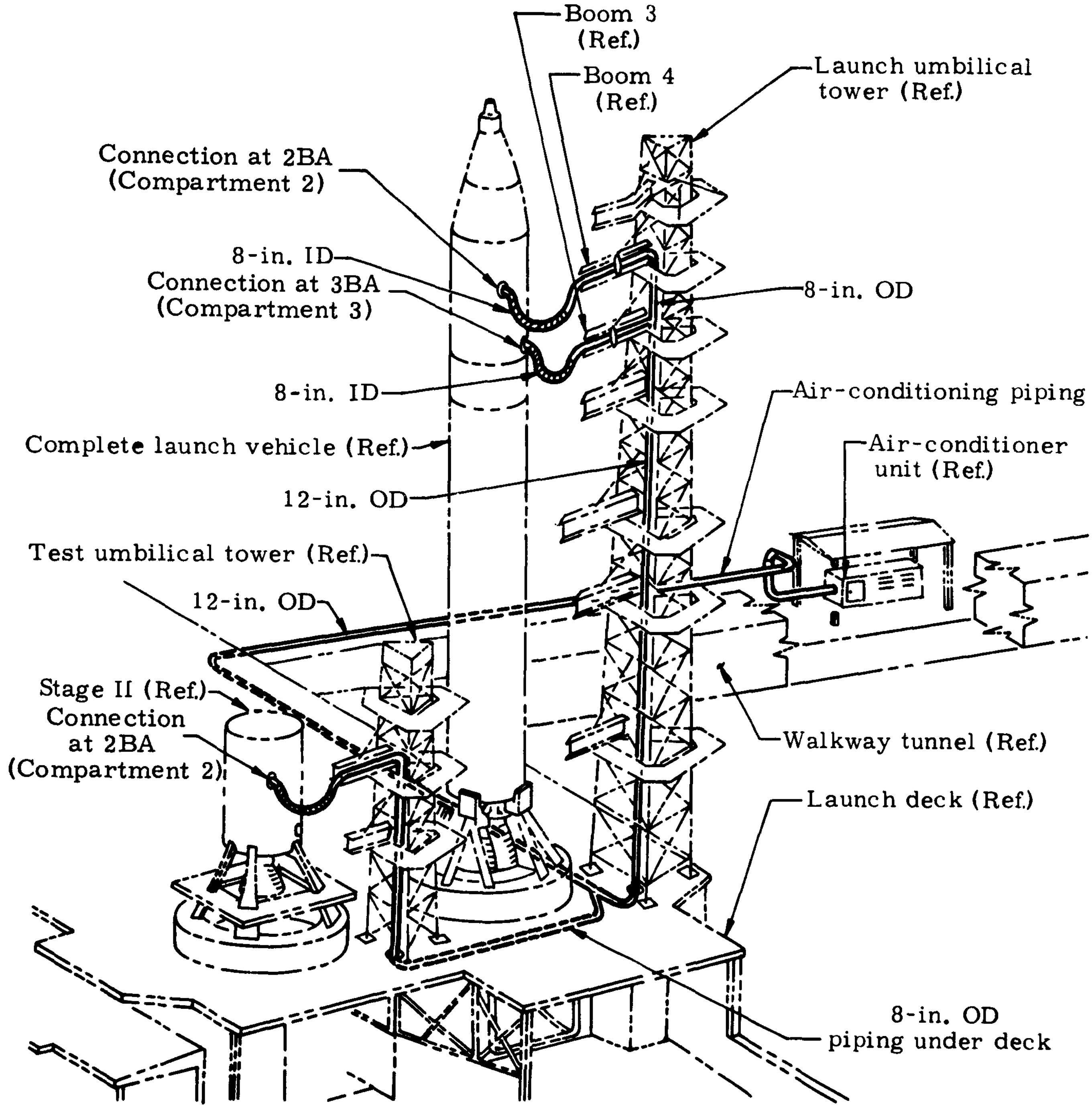


Fig. 7-30. Launch Vehicle Air-Conditioning System (Mechanical View)

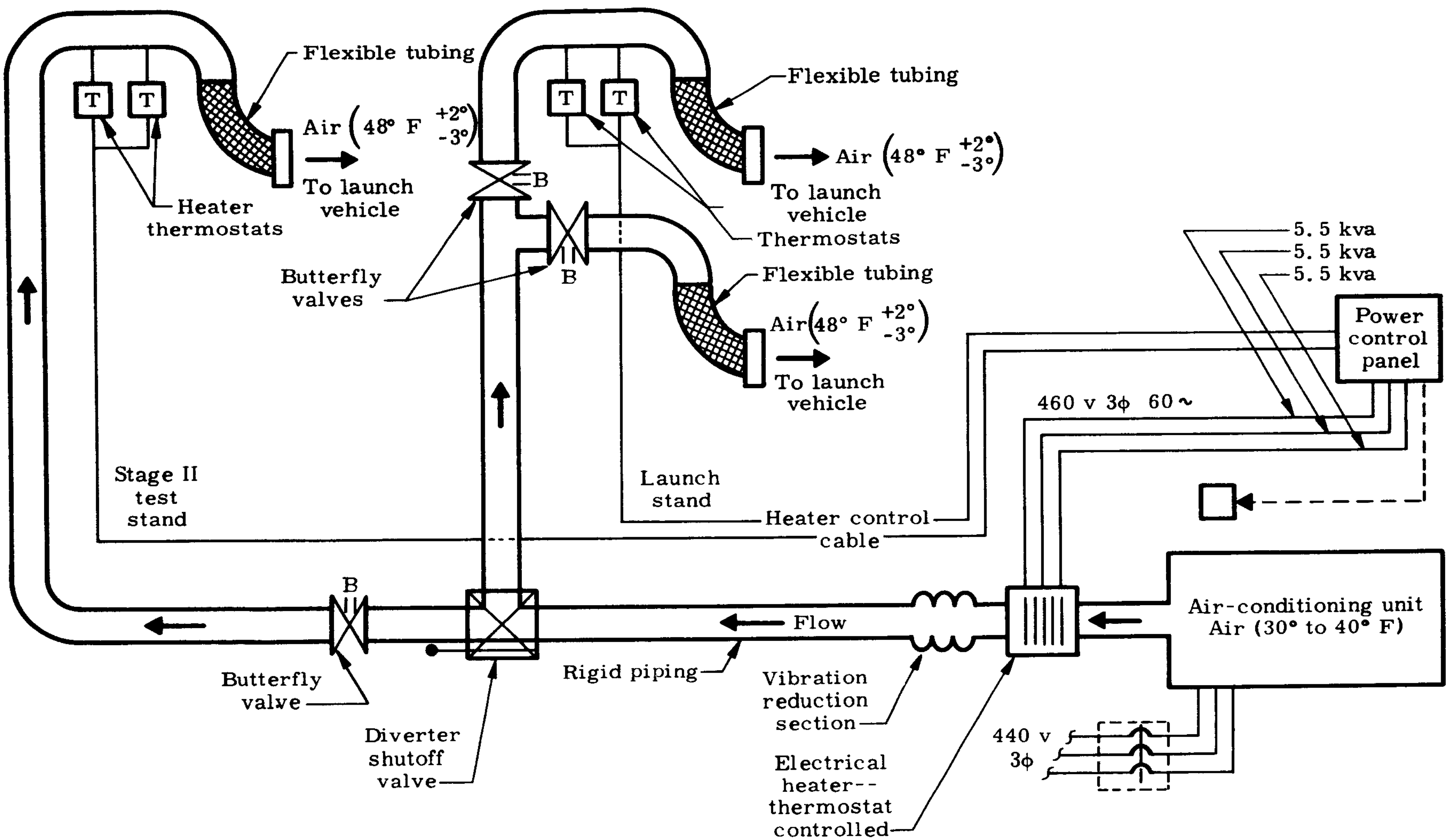


Fig. 7-31. Launch Vehicle Air-Conditioning System--Complex 19

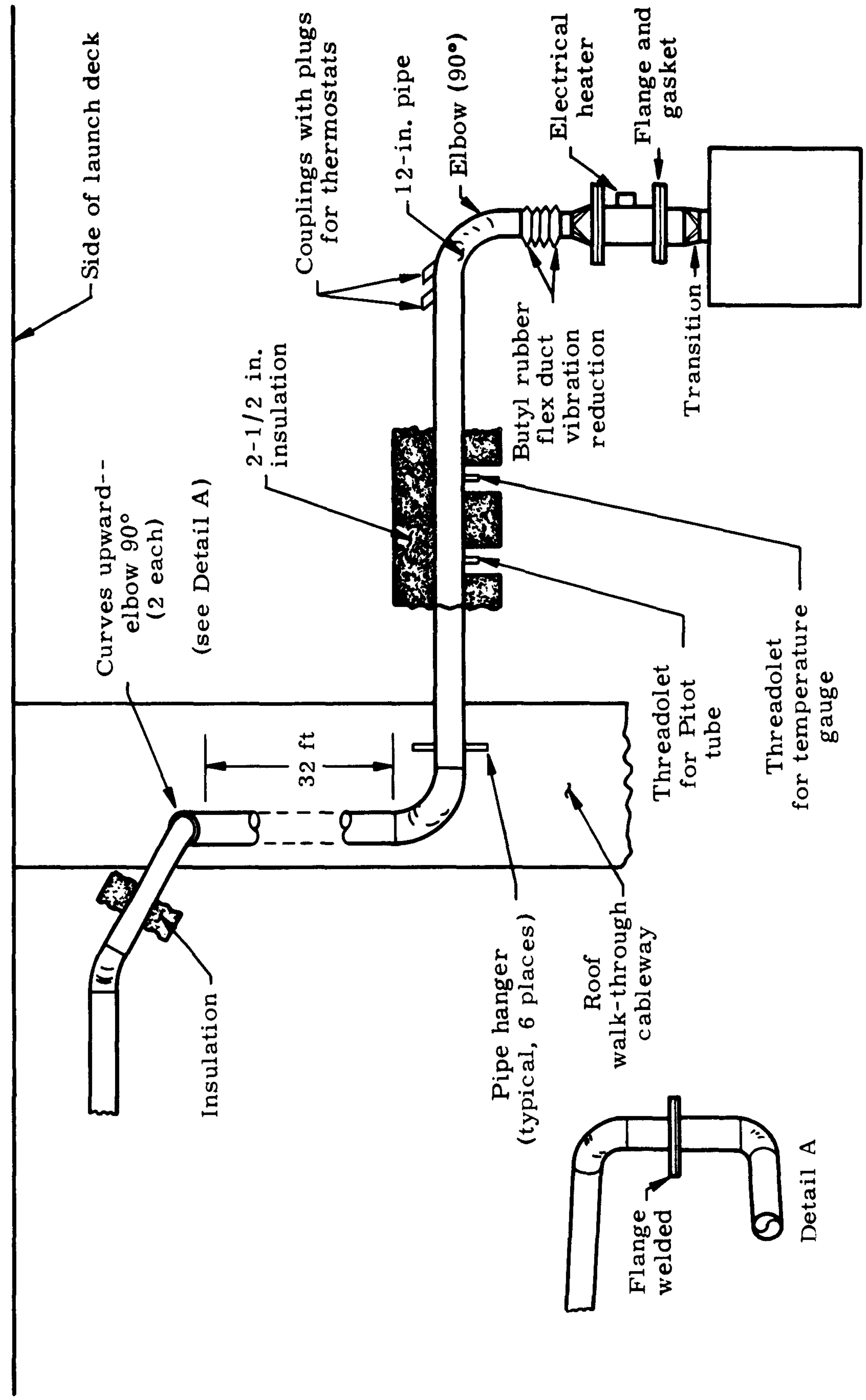


Fig. 7-32. Piping from Launch Vehicle Air-Conditioning Unit to Umbilical Towers

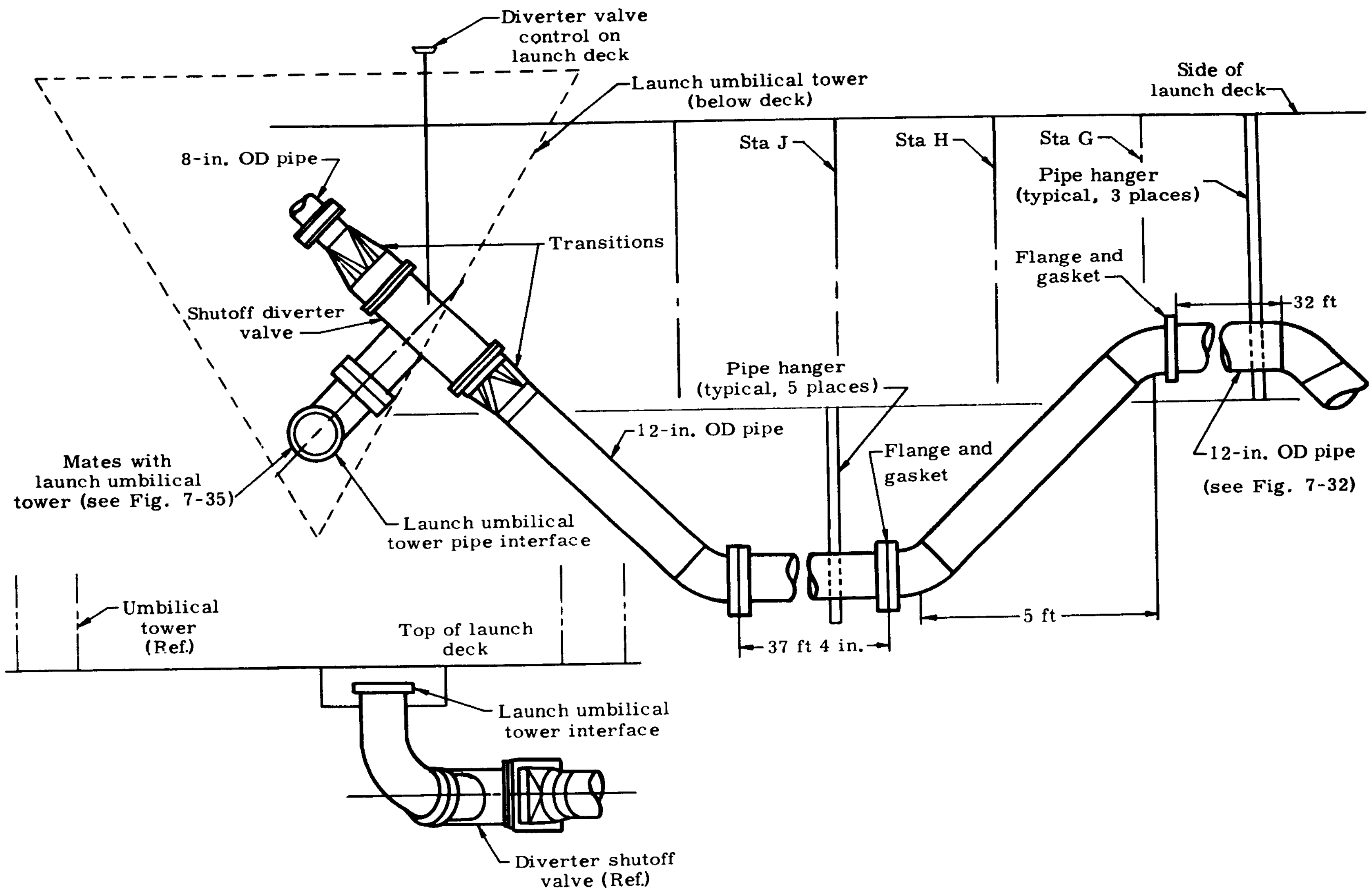


Fig. 7-33. Piping from Launch Vehicle Air-Conditioning Unit to Launch Umbilical Tower

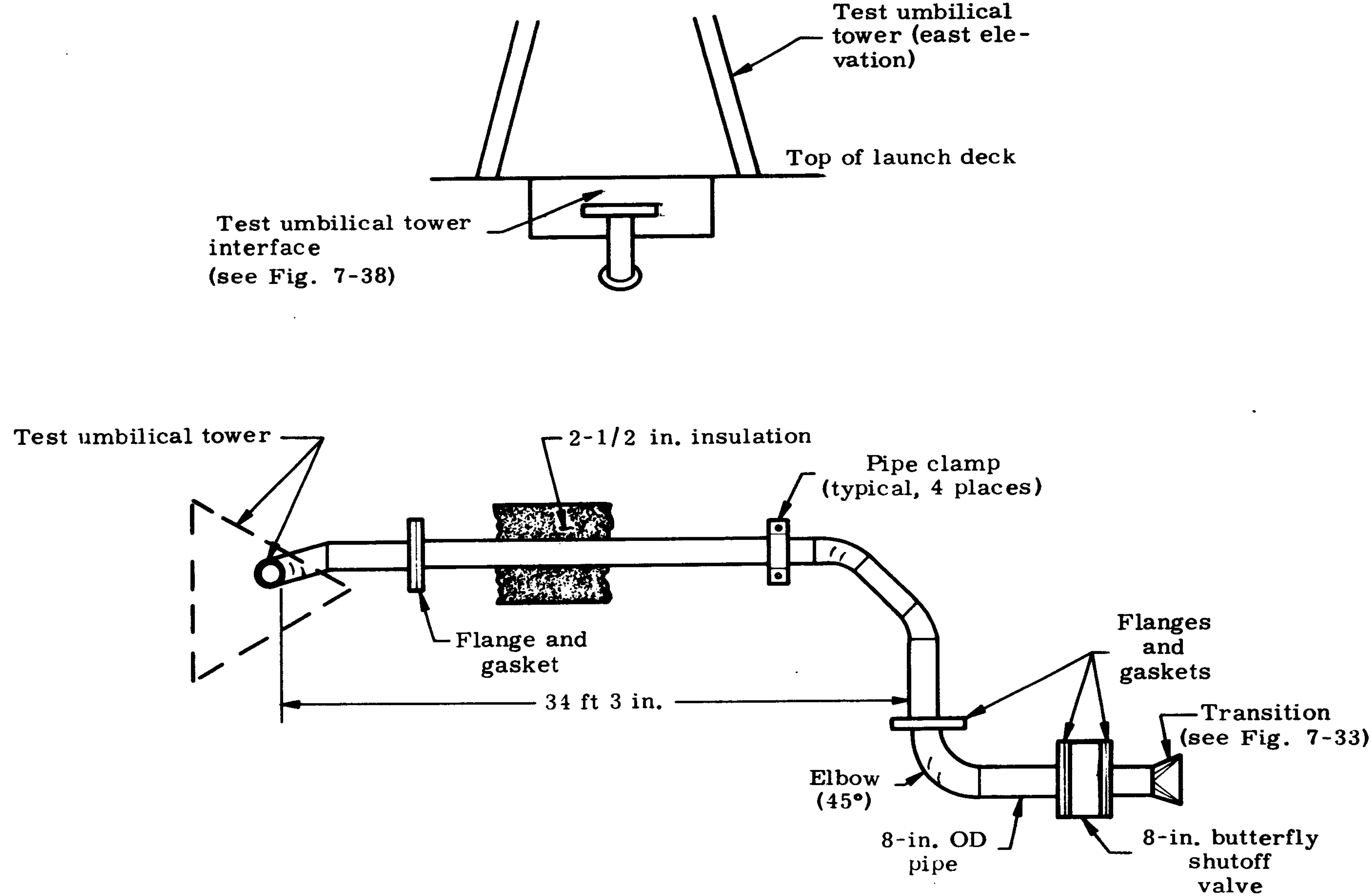


Fig. 7-34. Launch Vehicle Air-Conditioning Piping from Launch Umbilical Tower to Test Umbilical Tower

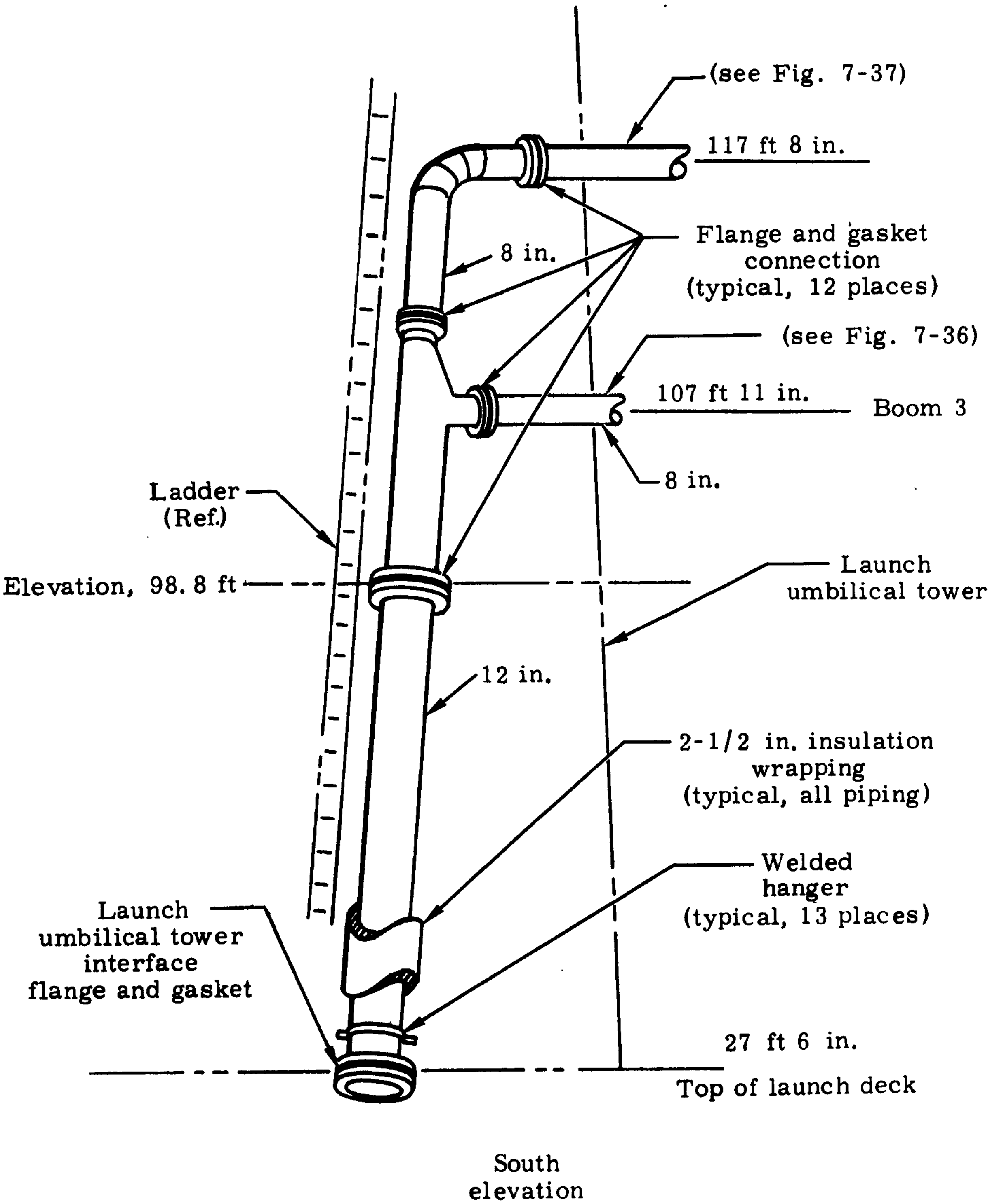
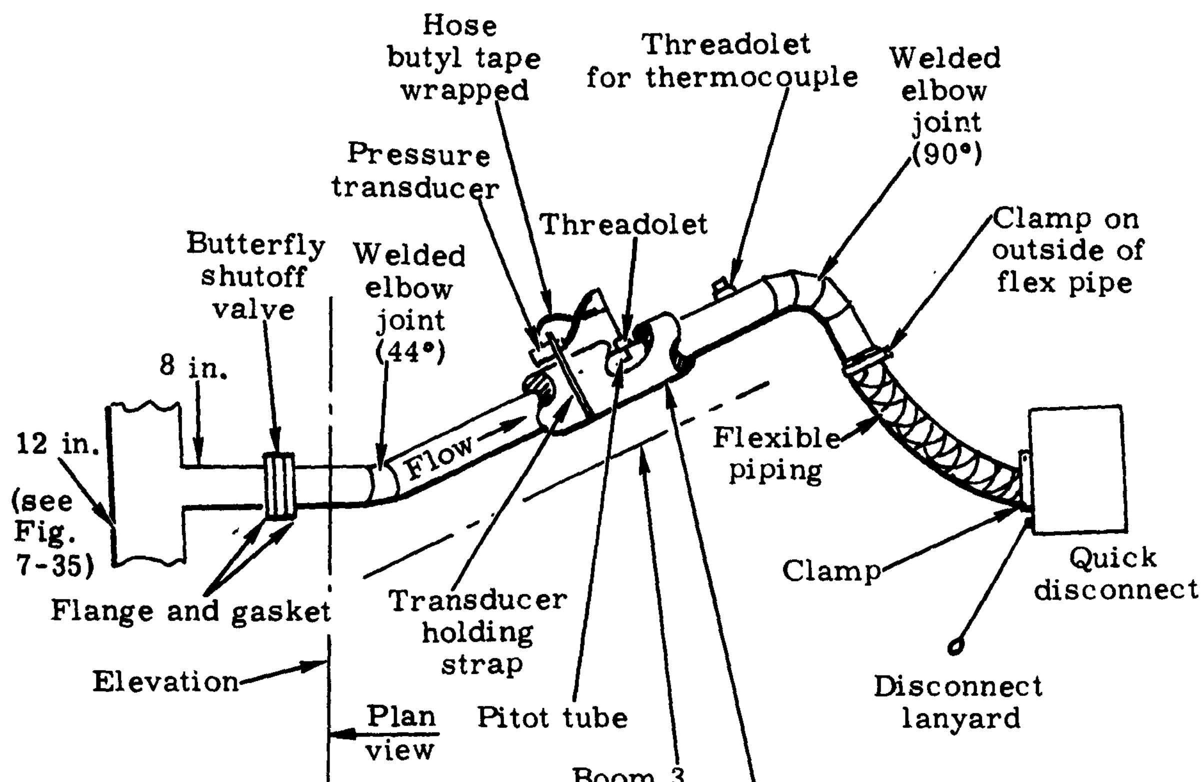


Fig. 7-35. Launch Umbilical Tower Launch Vehicle Air-Conditioning Piping



NOTE:

Elbows to be fabricated of 0.195 strips.

Fig. 7-36. Launch Vehicle Air-Conditioning System Compartment 3 Connections (Launch Umbilical Tower Boom 3)

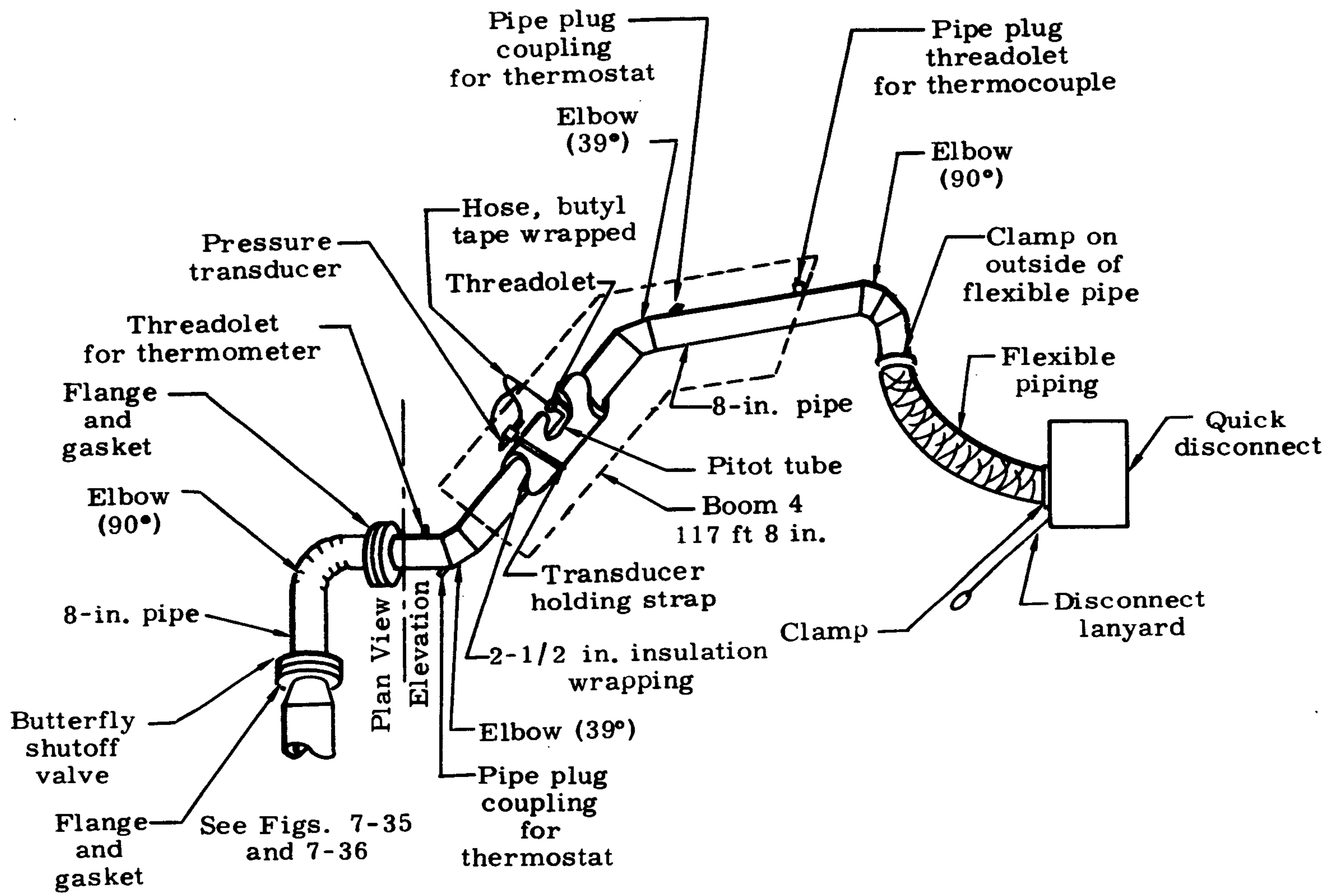


Fig. 7-37. Launch Vehicle Air-Conditioning System Compartment 2 Connections (Launch Umbilical Tower Boom 4)

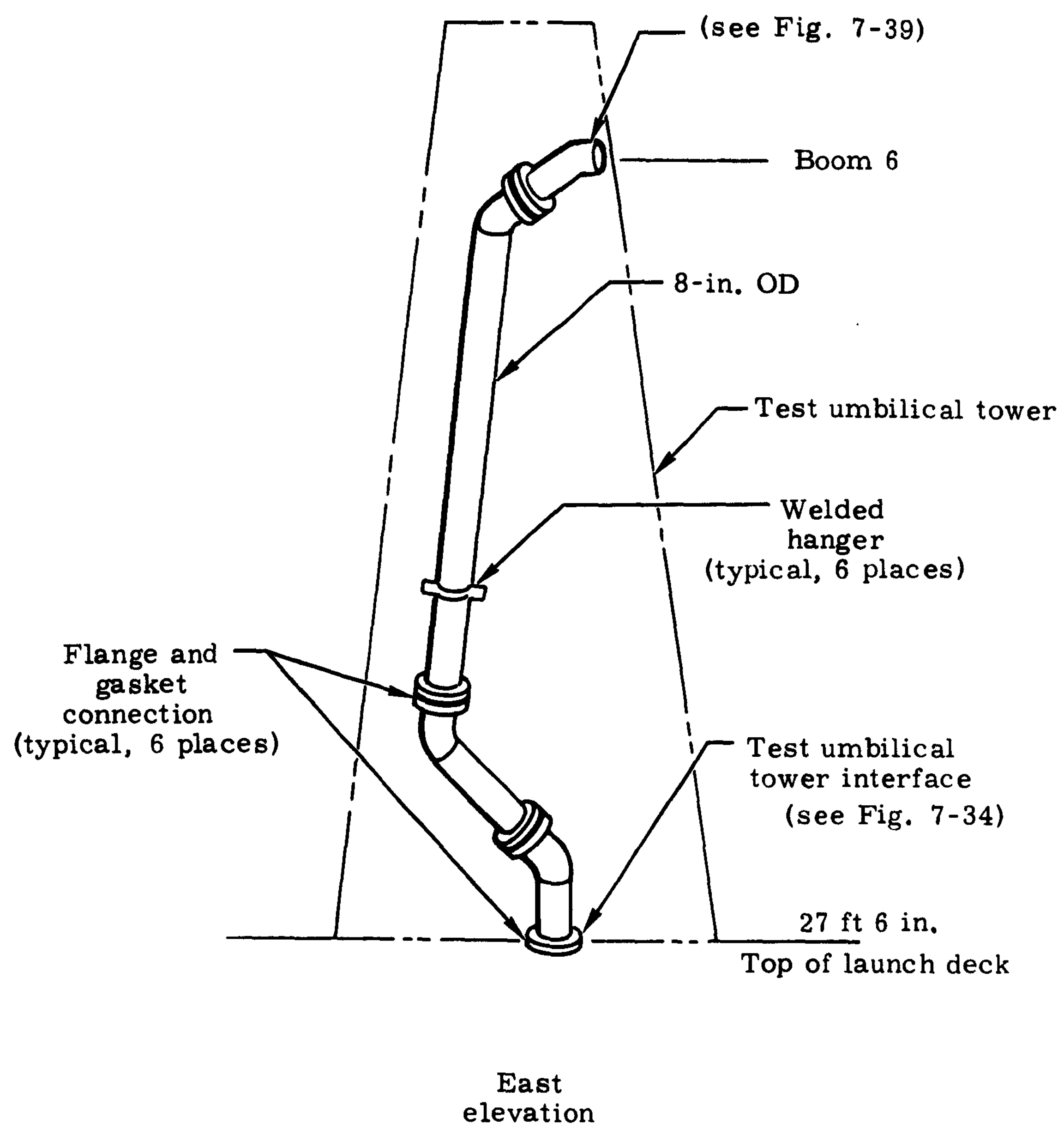


Fig. 7-38. Test Umbilical Tower Launch Vehicle Air-Conditioning Piping

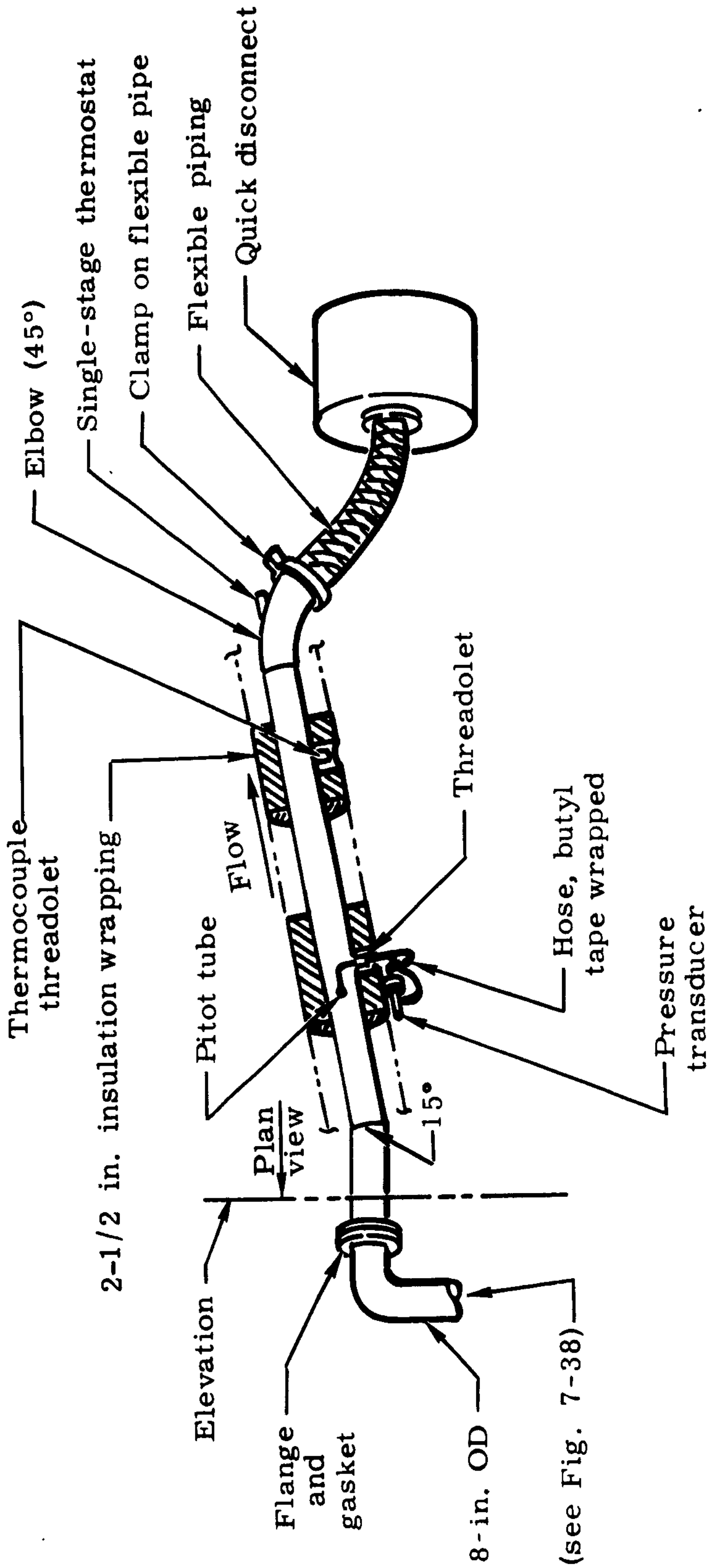


Fig. 7-39. Launch Vehicle Air-Conditioning System Compartment 2 Connections (Test Umbilical Tower Boom 6)

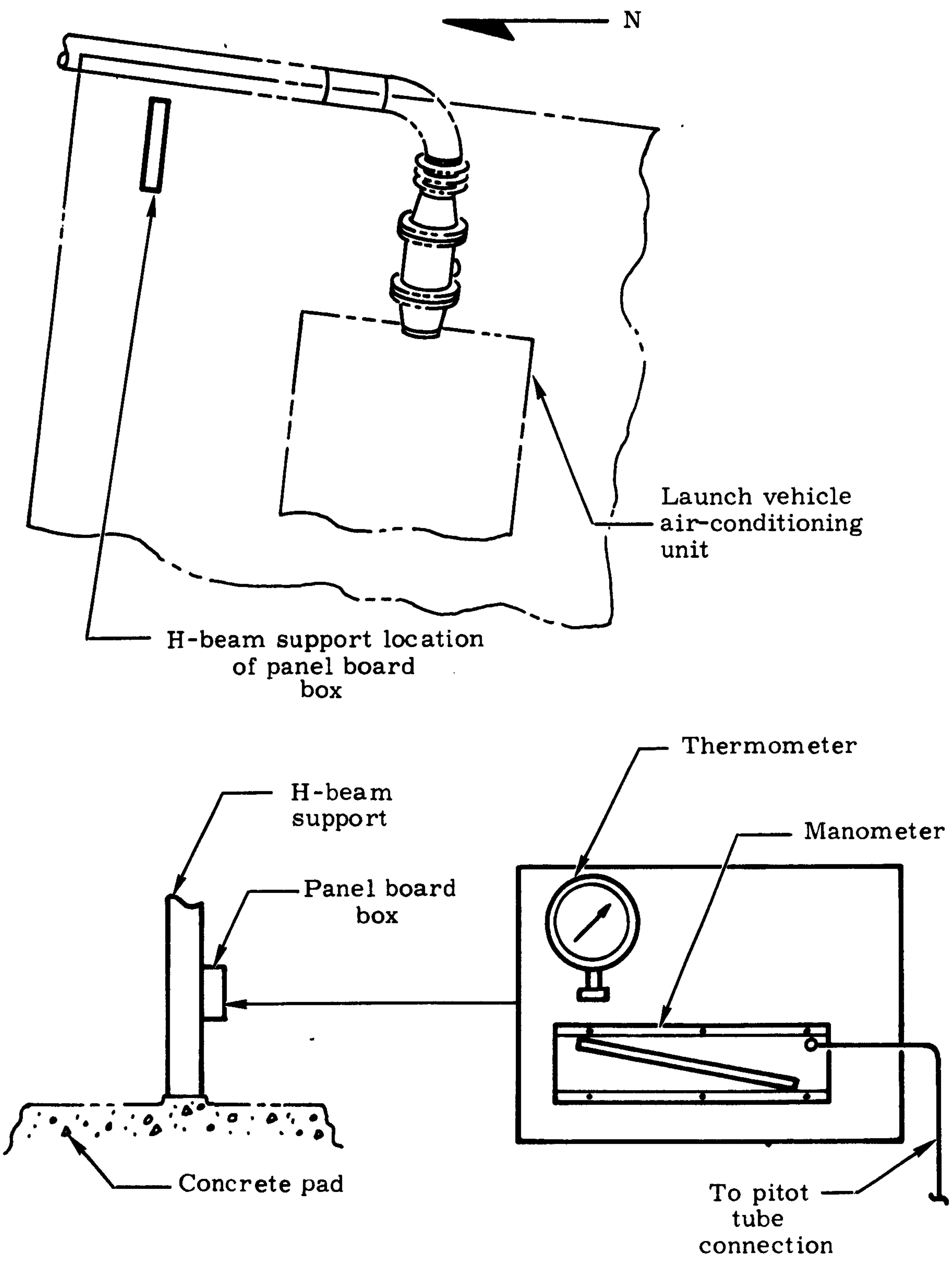


Fig. 7-40. Launch Vehicle Air-Conditioning System Panel Board Box Location and Equipment Contents

7.7 UMBILICAL BOOMS INSTALLATION

7.7.1 Description

Two umbilical towers service the launch vehicle and spacecraft during testing and launching.

The Complete Vehicle Umbilical Tower (CVUT) is a triangular, trussed steel facility structure capable of supporting seven umbilical booms for providing service lines to the complete launch vehicle and spacecraft. The boom numbers and elevations are given in the following tabulation.

	Elevation	
Boom No.	(ft)	(in.)
1	23	5-1/2
1-1/2	43	11
1-3/4	54	8-3/4
2	71	8
3	80	5
4	90	2
4-1/2	99	0

Booms Nos. 1, 2 and 3 are utilized from the existing configuration; booms Nos. 1-1/2, 1-3/4 and 4-1/2 are new; boom No. 4 has been modified. Booms Nos. 1 through 4 support service lines to the complete launch vehicle, and boom No. 4-1/2 supports service lines to the spacecraft.

A drop-weight system is installed on the CVUT (boom No. 4-1/2) to serve as a backup cable disconnect and to ensure the withdrawal of the spacecraft upper umbilical cable at launch.

The Second-Stage Umbilical Tower (SSUT) is a triangular, trussed steel structure capable of supporting two umbilical booms for providing service lines to the second stage of the launch vehicle. Boom No. 5 is mounted at an elevation of 13 feet 8 inches and boom No. 6 is at an elevation of 28 feet 5 inches.

The booms are constructed of aluminum alloy and are mounted rigidly in both the horizontal and vertical planes to the umbilical towers.

7.7.2 Sequence of Events

7.7.2.1 Boom No. 1 (CVUT) Installation (23-foot 5-1/2-inch elevation)

7.7.2.1.1 Install boom No. 1 assembly (Part No. 424-9178026-009) (Fig. 7-41) in accordance with Drawings 424-9178000, 424-9178011, 424-9178021 and 424-9178026.

Install the jib mast assembly (Kaiser Part No. D-74) to the umbilical tower.

Install the antiswing strut mast (Kaiser Part No. B-102) to the umbilical tower.

Assemble the following subassemblies to boom (Kaiser Part No. B-94).

(1) Lanyard attachment tripod assembly (Part No. 424-9178020-009).

(2) Boom guy strut assembly (Kaiser Part No. C-31-1).

(3) Horizontal strut assembly (Part No. 424-9178011-009).

7.7.2.2 Boom No. 1-1/2 (CVUT) Installation (43-foot 11-inch elevation)

7.7.2.2.1 Install boom No. 1-1/2 assembly (Part No. 424-9178028-009) (Fig. 7-41) in accordance with Drawings 424-9178000, 424-9178011 and 424-9178028.

Field-weld the jib mast support assembly (Part No. 424-9178028-039) to the umbilical tower.

Field-weld the jib mast support assembly (Part No. 424-9178028-019) to the umbilical tower.

Assemble the following subassemblies to boom (Part No. 424-9178037-009):

(1) Jib mast assembly (Part No. 424-9178028-029).

(2) Boom guy strut assembly (Part No. 424-9178034-019).

(3) Horizontal strut assembly (Part No. 424-9178011-019).

7.7.2.3 Boom No. 1-3/4 (CVUT) Installation (54-foot 8-3/4-inch elevation)

7.7.2.3.1 Install boom No. 1-3/4 assembly (Part No. 424-9178029-009) (Fig. 7-41) in accordance with Drawings 424-9178000 and 424-9178029.

Field-weld the lower beam assembly (Part No. 424-9178029-029) to the umbilical tower.

Field-weld the upper beam assembly (Part No. 424-9178029-019) to the umbilical tower.

Assemble the following subassemblies to boom (Part No. 424-9178033-009).

(1) Mast assembly (Part No. 424-9178029-039).

(2) Boom guy strut assembly (Part No. 424-9178034-009).

(3) Boom horizontal strut assembly (Part No. 424-9178032-009).

(4) Mounting bracket (Part No. 424-9178035-009).

7.7.2.4 Boom No. 2 (CVUT) Installation (71-foot 8-inch elevation)

7.7.2.4.1 Install boom No. 2 assembly, Part No. 424-9178026-019 (Fig. 7-41) in accordance with Drawings 424-9178000, 424-9178011, 424-9178026 and 424-9178048.

Install the jib mast assembly (Kaiser Part No. D-75) to the umbilical tower.

Install the antiswing strut mast (Part No. 424-9178024-009) to the umbilical tower.

Assemble the following subassemblies to boom (Kaiser Part No. B-96):

(1) Bracket assembly to boom in accordance with Drawing 424-9178048-019.

(2) Boom guy strut assembly (Part No. 424-9178022-009).

(3) Boom horizontal strut assembly (Part No. 424-9178011-029).

7.7.2.5 Boom No. 3 (CVUT) Installation (80-foot 5-inch elevation)

7.7.2.5.1 Install boom No. 3 assembly, Part No. 424-9178026-029 (Fig. 7-41) in accordance with Drawings 424-9178000, 424-9178011 and 424-9178026.

Install the jib mast assembly (Kaiser Part No. D-76) to the umbilical tower.

Install the antiswing strut mast (Kaiser Part No. B-104) to the umbilical tower.

Assemble the following subassemblies to boom (Kaiser Part No. B-97):

(1) Protective covers (Parts Nos. 424-9178040-009, -019, and -029).

(2) Boom extension assembly (Part No. 424-9178030-009).

(3) Boom guy strut assembly (Part No. 424-9178022-019).

(4) Boom horizontal strut assembly (Part No. 424-9178011-039).

7.7.2.6 Boom No. 4 (CVUT) Installation (90-foot 2-inch elevation)

7.7.2.6.1 Install boom No. 4 assembly, Part No. 424-9178051-009 (Fig. 7-41) in accordance with Drawings 424-9178000, 424-9178022, 424-9178026, 424-9178048, and 424-9178050.

Assemble post (Part No. 424-9178053-009) to the umbilical tower.

Assemble the strut (Part No. 424-9178053-019) to the umbilical tower.

Assemble strut (Part No. 424-9178053-029) to the umbilical tower.

Assemble the following subassemblies to boom (Part No. 424-9178051-009).

(1) Boom guy strut assembly (Part No. 424-9178022-039).

(2) Horizontal strut assembly (Part No. 424-9178053-039).

(3) Jib mast assembly (Part No. 424-9178049-009).

(4) Protective covers (Parts Nos. 424-9178052-009 and -019).

7.7.2.7 Boom No. 4-1/2 (CVUT) Installation (99-foot elevation)

7.7.2.7.1 Install boom No. 4-1/2 assembly, Part No. 424-981001-009 (Fig. 7-41) in accordance with Drawings 424-9810000 and 424-9820000.

Install the strut (Part No. 424-9810011-039) to the umbilical tower.

Install the strut (Part No. 424-9810011-029) to the umbilical tower.

Assemble the following subassemblies to boom No. 2-1/4 (Part No. 424-9810001-009):

(1) Protective covers (Parts Nos. 424-9810002-009 and -019).

(2) Boom guy strut assembly (Part No. 424-9810009-009).

(3) Strut (Part No. 424-9810011-019).

(4) Jib mast (Part No. 424-9810004-009).

(5) Spacecraft upper umbilical boom (Part No. 424-9820001-009).

(6) Three sets of cable pulleys utilized for drop-weight cable disconnect system.

7.7.2.8 Drop-Weight Disconnect Installation

7.7.2.8.1 Install drop-weight disconnect system in accordance with Fig. 7-42, Details GG and HH.

Mount cable pulleys to the umbilical tower.

Mount the squib-actuated release mechanism to the umbilical tower.

Mount the drop-weight chute to the umbilical tower.

Insert the umbilical cable retracting lines through pulleys and attach to the bridle.

Connect the short cable between the other end of the bridle and drop-weight.

7.7.2.9 Boom No. 5 (SSUT) Installation (13-foot 8-inch elevation)

7.7.2.9.1 Install boom No. 5 assembly, Part No. 424-9178048-009 (Fig. 7-43) in accordance with Drawings 424-9178000, 424-9178043, 424-9178044 and 424-9178048.

Field-weld the boom assembly (Part No. 424-9178043-019) to the umbilical tower.

Field-weld in place the boom horizontal strut tower mounts to the umbilical tower.

Assemble the following subassemblies to boom No. 5 (Part No. 424-9178044-009):

(1) Boom guy strut assembly (Kaiser Part No. C-31-5).

(2) Antiswing strut assembly (Part No. 424-9178045-009).

(3) Boom assembly (Part No. 424-9178043-029).

Install and bolt in place boom No. 5 (Part No. 424-9178044-009) and subassemblies to the umbilical tower and boom assembly (Part No. 424-9178043-019).

7.7.2.10 Boom No. 6 (SSUT) Installation (28-foot 5-inch elevation)

7.7.2.10.1 Install boom No. 6 assembly, Part No. 424-9178044-019 (Fig. 7-43) in accordance with Drawings 424-9178000, 424-9178044 and 424-9178047.

Assemble the following subassemblies to boom No. 6 (Kaiser Part No. B-99):

(1) Jib mast assembly (Kaiser Part No. D-76).

(2) Antiswing strut assembly (Kaiser Part No. B-104).

(3) Boom guy strut assembly (Kaiser Part No. C-31-6).

(4) Antiswing strut assembly (Part No. 424-9178047-009).

(5) Antiswing strut support guy (Kaiser Part No. C-32-6).

7.7.3 Checkout Procedure

7.7.3.1 Visual Inspection

7.7.3.1.1 Visually inspect to ensure that all components have been properly installed and adequately supported.

7.7.4 Documentation

Drawing No.	Title	Boom No.
424-2054000	Umbilical Tower, Complete Vehicle	All
424-2154000	Umbilical Tower, Stage II	All
424-9178000	Umbilical Boom Set, Complete Vehicle and Stage II Launch Vehicle	All except 4-1/2
424-9178011	Strut Assembly	1, 1-1/2, 2, 3
424-9178020	Tripod Assembly, Lanyard Attachment	1
424-9178021	Lanyard Attachment Installation, Umbilical Boom	1
424-9178022	Guy Strut Assembly, Umbilical Tower	2, 3, 4
424-9178024	Antiswing Strut Mast, Umbilical Boom, Complete Launch Vehicle, Elevation 71 feet 8 inches, Top of Steel	2
424-9178026	Boom Assembly, Umbilical Tower, Complete Launch Vehicle	1, 2, 3, 4

Drawing No.	Title	Boom No.
424-9178027	Pivot Rod	2
424-9178028	Complete Boom Assembly, Umbilical Tower, Elevation 43 feet 11 inches	1-1/2
424-9178029	Boom Assembly, Umbilical Tower, Elevation 54 feet 8-3/4 inches	1-3/4
424-9178030	Boom Extension Assembly, Umbilical Tower, Complete Launch Vehicle	3
424-9178031	Bracket Assembly, Umbilical Tower	1-3/4, 1-3/4
424-9178032	Strut Assembly, Umbilical Tower	1-3/4
424-9178033	Pipe	1-3/4
424-9178034	Boom Guy Strut Assembly	1-3/4, 1-1/2
424-9178035	Mounting Bracket	1-3/4
424-9178037	Boom	1-1/2
424-9178039	Bracket Assembly, Umbilical Tower, Elevation 43 feet 11 inches	1-1/2
424-9178040	Protection Cover, Umbilical Boom, Complete Launch Vehicle, Elevation 80 feet 5 inches, Top of Steel	3
424-9178043	Boom Installation, Elevation 13 feet 8 inches, Umbilical Tower, Stage II	5
424-9178044	Boom Assembly, Umbilical Tower, Stage II	5, 6
424-9178045	Antiswing Strut Assembly	5
424-9178047	Support, Umbilical Boom, Stage II	6
424-9178048	Bracket Installation, Spill-Off, Umbilical Boom	5, 2

Drawing No.	Title	Boom No.
424-9178049	Jib Mast Assembly, Umbilical Tower, Elevation 90 feet 2 inches	4
424-9178050	Boom Installation, Umbilical Tower, Elevation 90 feet 2 inches	4
424-9178051	Boom Assembly, Umbilical Tower, Elevation 90 feet 2 inches	4
424-9178052	Protective Cover, Boom Assembly, Elevation 90 feet 2 inches	4
424-9178053	Support Boom, Assembly, Elevation 90 feet 2 inches	4
424-9810000	Boom Installation, Umbilical Tower, Elevation 99 feet 0 inches	4-1/2
424-9810001	Boom Assembly	4-1/2
424-9810002	Protective Cover	4-1/2
424-9810004	Jib Mast	4-1/2
424-9810009	Guy Strut	4-1/2
424-9810011	Strut	4-1/2
424-9820000	Boom Installation, Spacecraft, Upper, Umbilical Tower, Complete Launch Vehicle	4-1/2
424-9820001	Boom Assembly, Upper, Spacecraft	4-1/2

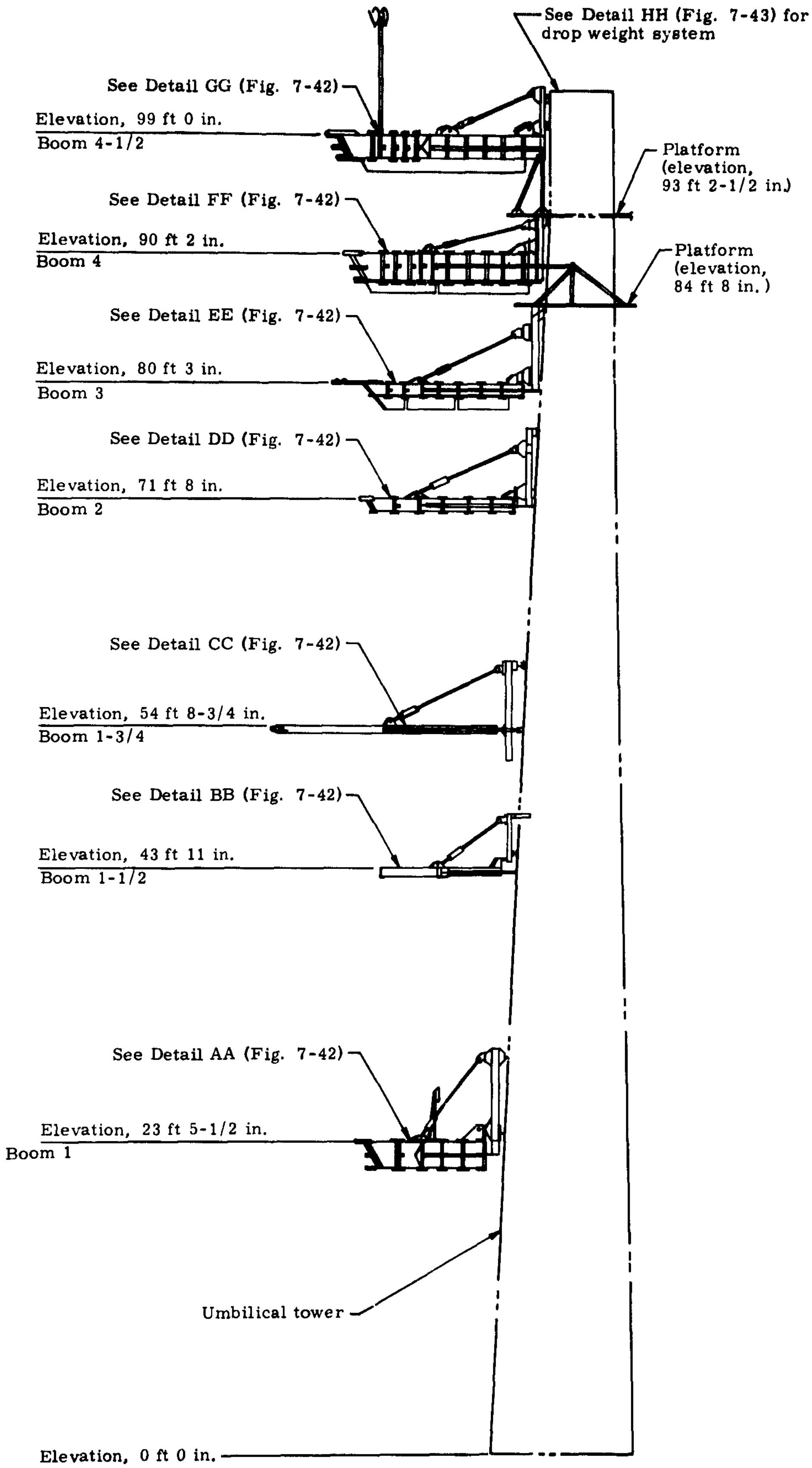


Fig. 7-41 . Complete Vehicle Umbilical Tower Boom Installation

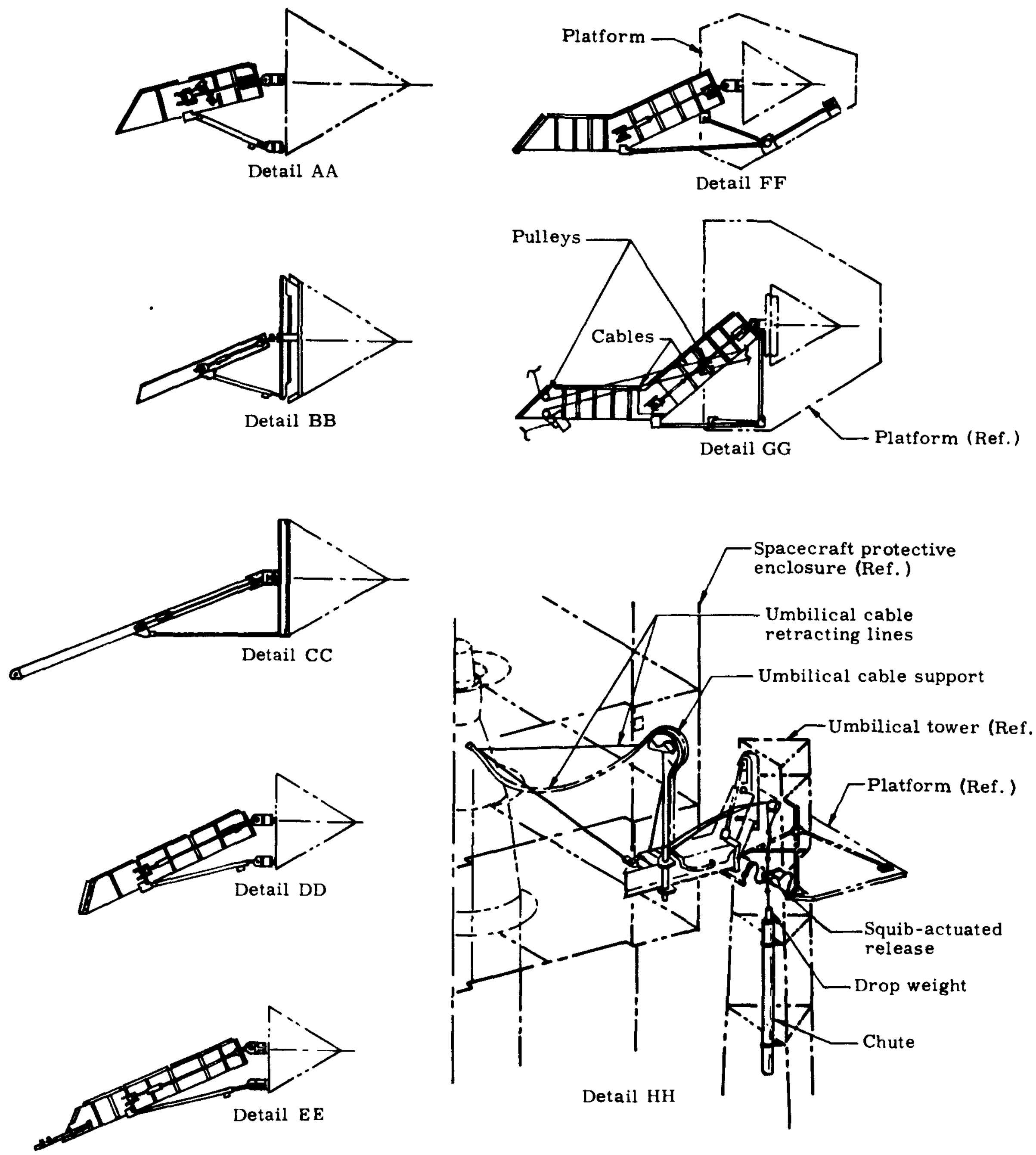


Fig. 7-42. Details of Complete Vehicle Umbilical Tower Booms and Dropweight System

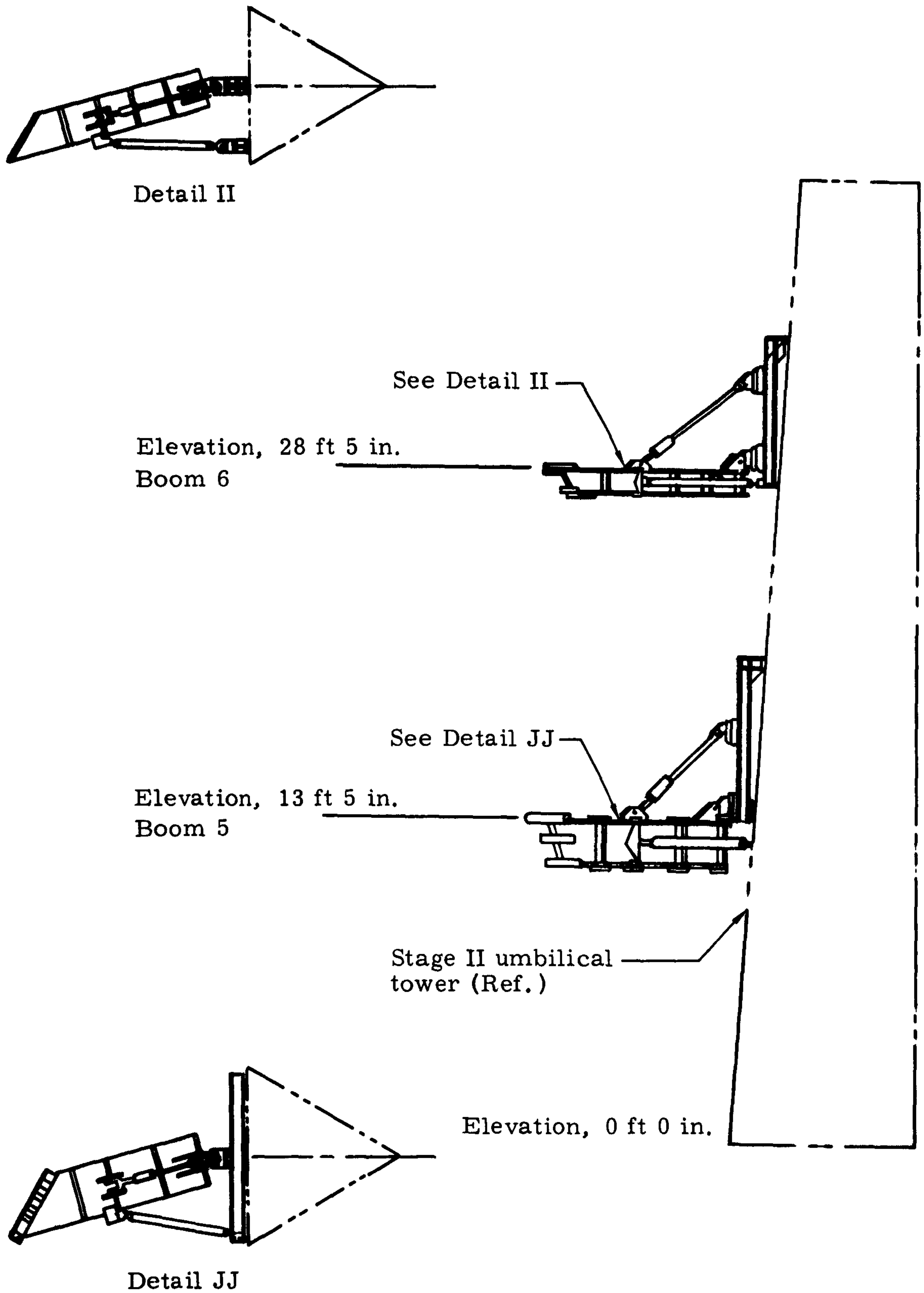


Fig. 7-43. Stage II Umbilical Tower Boom Installation and Details

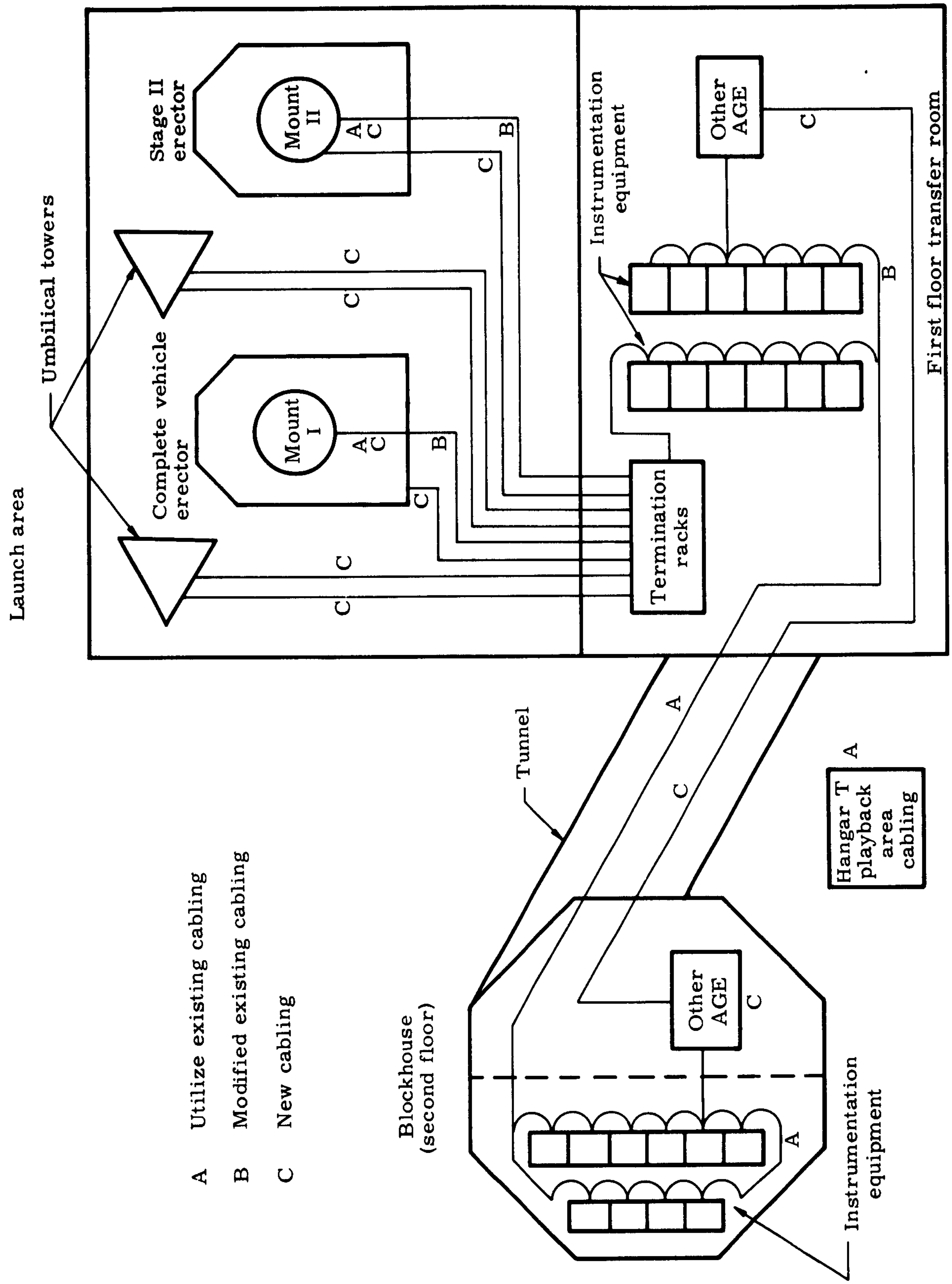


Fig. 7-44. Instrumentation Cabling

7.8 GROUND INSTRUMENTATION EQUIPMENT

7.8.1 Description

The Ground Instrumentation Equipment (GIE), CP 6000, is required to obtain performance evaluation data from the Gemini launch vehicle. The following are the primary functions of the instrumentation equipment.

(1) Provide data displays and recording support of functional tests conducted on the launch vehicle at the launch site in preparation for captive firings and launchings.

(2) Provide visual data displays for captive firing and prelaunch operations.

(3) Make permanent recordings of data through landline and telemetry channels during captive firings and prelaunch operations.

(4) Provide "quick-look" data displays and playback support of captive firings and launches.

(5) Be capable of programming any data channel into any one of several types of recorders in order to maintain versatility of recording channel utilization.

(6) Modify the electrical signals received through landlines to a form that is electrically compatible with the input to the recorders.

(7) Permit receiving, discriminating and decoding of RF signals from FM transmitters either as radiated signals from the launch vehicle transmitting antennas and the blockhouse receiving antenna system, or via a closed-loop system consisting of antenna hats to fit over the launch vehicle transmitting antennas and RF coaxial transmission lines to the blockhouse.

(8) Provide for remote control of calibration voltages for the airborne telemetry B+ supply and the ground instrumentation recorders.

(9) Provide instrumentation on the launch vehicle thrust mounts for weight, side load and thrust measurements.

(10) Monitor air-conditioning inputs to the launch vehicle.

Table 7-3 presents the instrumentation equipment listed in accordance with the location of the equipment.

7.8.2 Sequence of Events

7.8.2.1 GIE Installation, Blockhouse Second Floor

7.8.2.1.1 Install the Ground Instrumentation Equipment listed under (1) (a) in Table 7-3 on the second floor of the blockhouse.

7.8.2.1.2 The units shall be located and installed in accordance with Drawing No. 424-2251000, AGE installations, Blockhouse, Second Floor, Installation of Complex 19.

7.8.2.2 GIE Installation, Transfer Room

7.8.2.2.1 Utilize the Ground Instrumentation Equipment listed under (1) (b) of Table 7-3 as presently installed on the second floor of the blockhouse.

7.8.2.2.2 Install the Ground Instrumentation Equipment listed under (2) (a) of Table 7-3 in the transfer room located on the first floor of the approach ramp building.

7.8.2.2.3 The units shall be located and installed in accordance with Drawing No. 424-2152400, Equipment Installation Transfer Room and Lower Equipment Room.

7.8.2.3 GIE Installation, Hangar T Playback Area

7.8.2.3.1 Utilize the Ground Instrumentation Equipment listed under (2) (b) of Table 7-3 as presently installed in the transfer room located on the first floor of the approach ramp building.

7.8.2.3.2 Install the Ground Instrumentation Equipment listed under (3) (a) of Table 7-3 in the playback area of Hangar T (Fig. 7-45).

7.8.2.3.3 The units shall be located and installed in accordance with Drawing 424-5000000, AGE Installation, Hangar T Complete Industrial Area.

7.8.2.4 Telemetry Ground Station Receiving Antenna Installation

7.8.2.4.1 Utilize the Ground Instrumentation Equipment listed under (3) (b) of Table 7-3 in the playback area of Hangar T.

7.8.2.4.2 Install the telemetry ground station receiving antenna (CP 6570) listed under (4) of Table 7-3 on the tunnel near the blockhouse.

7.8.2.4.3 The unit shall be located and installed in accordance with Drawing 424-2052000, AGE Installations, Approach Ramp and Launch Deck Complete.

7.8.2.5 Instrumentation Facility Transducer Installation

7.8.2.5.1 Install the instrumentation facility transducers (CP 2081) listed under (5) of Table 7-3 in the launch deck area.

The units shall be located and installed in accordance with Drawing 424-2081000, Transducer Assembly Instrumentation.

TABLE 7-3
Instrumentation Equipment and Locations

Part No.	Item	Control Point	Quantity	Location Spot No.
(1) Blockhouse, Second Floor				
(a) To be installed				
424-6180000	Ampex rack assembly	6180	2	AH 112, AH 114
424-6210000	Ampex rack assembly	6210	2	AH 113, AH 115
424-6430000	FM/FM ground station (discriminator rack)	6430	1	AH 121
424-6450000	FM/FM ground station (discriminator rack)	6450	1	AH 119
424-6460000	FM/FM ground station (patch rack)	6460	1	AH 117
424-6470000	FM/FM ground station (receiver rack)	6470	1	AH 118
424-6760000	FM/FM ground station discriminator attenuator rack assembly	6760	1	AH 108
424-6690000	PCM/video decoder rack	6690	2	AH 135, AH 136
327-X200000	Test cart (portable)	6200	1	AH 166
327-X740000	Oscilloscope cart (portable)	6740	1	AH 147
327-X750000	VCO test cart (portable)	6750	1	AH 165
327-X800000-9	General test cart	6800A	1	AH 167
424-6300000	Instrumentation console	6300A	1	AH 143, AH 144, AH 145
327-X300000-19	Instrumentation console	6300B	1	AH 146
327-X300000-29	Instrumentation console	6300C	1	AH 142
424-6230000	Secondary power distribution rack assembly	6230	1	AH 104
327-4728700-9	Electrical equipment weight and thrust measuring system (3-bay rack)	6400	1	AH 247, AH 248, AH 249
327-X014005-9	Headset, telephone	6014	41	--
327-X024000	Patch cord assembly	6024	1 set	--
424-6001000	Cable assemblies	6001	1 set	--
(b) Existing equipment				
327-X110000-9	Strip chart recorder rack assembly (with digitizer)	6110A	2	AH 148, AH 150
327-X110000-19	Strip chart recorder rack assembly (with digitizer)	6110B	2	AH 149, AH 151
327-X110000-29	Strip chart recorder rack assembly (with digitizer)	6110C	1	AH 152
327-X170000-9	Sanborn direct writer rack assembly	6170A	1	AH 140
327-X170000-19	Sanborn direct writer rack assembly	6170B	1	AH 141

Part No.	Item	Control Point	Quantity	Location Spot No.
327-X170000-29	Sanborn direct writer rack assembly	6170C	1	AH 138
327-X170000-39	Sanborn direct writer rack assembly	6170D	1	AH 139
327-X120000-9	Strip chart recorder rack (without digitizer)	6120A	1	AH 160
327-X120000-19	Strip chart recorder rack (without digitizer)	6120B	3	AH 161, AH 162, AH 164
327-X120000-29	Strip chart recorder rack (without digitizer)	6120C	1	AH 163
327-X480000	Patch rack assembly	6480	1	AH 124
327-X500000	Patch rack assembly	6500	1	AH 122
327-X240000	Power monitor No. 1 rack assembly	6240	1	AH 107
327-X250000	Power monitor No. 2 rack assembly	6250	1	AH 106
327-X220000-29	Main power distribution rack assembly	6220	1	AH 105
424-6490000	Patch rack assembly	6490	1	AH 123
424-6130000	Multipoint and events recorder rack assembly	6130	1	AH 159
327-X440000	FM/FM ground station (discriminator rack)	6440	1	AH 120
327-X101000	Frequency meter rack assembly	6101	1	AH 137
327-X100000-9	Spare rack assembly	6100A	2	AH 101, AH 109
327-X100000-19	Spare rack assembly	6100B	1	AH 110
327-X030000-9	Accessory rack assembly	6030	1 set	AH 111
327-X150000-19	Oscillograph rack assembly (permanent)	6150B	1	AH 102
327-X310000	Time distribution rack assembly	6310	1	AH 116
327-X190000-9	Voltage-controlled oscillograph rack assembly	6190A	3	AH 125, AH 128, AH 131
327-X190000-19	Voltage-controlled oscillograph rack assembly	6190B	5	AH 126, AH 127 AH 129, AH 130, AH 132
327-X510000-9	Strip chart recorder rack (with slide wire)	6510A	1	AH 153
327-X510000-19	Strip chart recorder rack (with slide wire)	6510B	3	AH 154, AH 155, AH 157
327-X510000-29	Strip chart recorder rack (with slide wire)	6510C	1	AH 156

(2) Transfer Room, First Floor

(a) To be installed

424-6730000	Voltage network rack assembly	6730	1	BA 109

Part No.	Item	Control Point	Quantity	Location Spot No.
327-X560000	Events and voltage networks patch rack	6560	1	BA 107
	BLH equipment	6400	1	BA 206
424-6390000	Airborne instrumentation system checkout equipment (two racks located on second floor)	6390	1	BD 701, BD 702
424-6900000	Signal simulators and test equipment (portable)	6900	1	--
(b) Existing equipment				
327-X340000-9	Signal conditioner bridge rack assembly	6340A	1	BA 114
327-X340000-19	Signal conditioner bridge rack assembly	6340B	1	BA 115
327-X340000-29	Signal conditioner bridge rack assembly	6340C	1	BA 116
327-X370000-9	High frequency power supply rack assembly	6370A	1	BA 111
327-X370000-19	High frequency power supply rack assembly	6370B	1	BA 112
327-X350000	Signal conditioner total flow rack assembly	6350	1	BA 118
327-X320000	Flow rate rack assembly	6320	1	BA 119
327-X330000	Potentiometer transducer signal conditioner rack assembly	6330	1	BA 124
327-X360000-9	Thermocouple signal conditioner rack assembly	6360A	1	BA 123
327-X360000-19	Thermocouple signal conditioner rack assembly	6360B	1	BA 121
327-X780000	Bridge calibration power supply rack assembly	6780	1	BA 113
327-X790000	T/C bias supply rack assembly	6790	1	BA 122
327-X540000-19	Patch rack assembly	6540	1	BA 101
327-X890000	RF video and patch rack assembly	6890	1	BA 125
327-X520000	Patch rack assembly (bridge)	6520	1	BA 108
327-X550000	Flow and high frequency patch rack	6550	1	BA 106
327-X530000	Thermocouple and multi-point patch rack	6530	1	BA 102
327-X880000	Thermocouple reference junction rack assembly	6880	1	BA 104
327-X810000	Junction patch No. 1 rack assembly	6810	1	BA 105
327-X820000	Junction patch No. 2 rack assembly	6820	1	BA 103
327-X270000	Power distribution rack assembly	6270	1	BA 126

Part No.	Item	Control Point	Quantity	Location Spot No.
327-X100000	Spare rack	6100C	1	BA 110
327-X100000	Spare rack	6100D	2	BA 117, BA 120

(3) Hangar T Instrumentation Playback Area

(a) To be installed

Part No.	Item	Control Point	Quantity	Location Spot No.
804C5900170-009	Magnetic tape recorder rack (2-bay rack)	5900	1	P 15, P 16
804C5900170-039	Magnetic tape recorder rack (2-bay rack)	5900	1	P 10, P 11
804B5906150-59	PCM decoder rack	5906	1	P 35, P 36
327-2352000	Oscillograph processor	2352	2	--
PC640300222-1	Datarite (recorder) magazine (portable)	6640	2	--

(b) Existing equipment

Part No.	Item	Control Point	Quantity	Location Spot No.
327-X0060004	Cabling, external--playback area	6006	1	--
327-X0070005	Instrumentation ground bus system	6007	1	--
804C5900216	Antenna and preamplifier installation	5900	1	--
804C5900250-009	Patch rack assembly	5900	1	P 19
327-X200010	Test cart assembly (portable)	6200A	1	--
327-X800000-19	General test cart (portable)	6800	1	--
327-X740000	Oscilloscope cart (portable)	6740	1	--
327-X870000-9	Direct writer-recorder rack assembly	6870A	1	P 26
327-X870000-19	Direct writer-recorder rack assembly	6870B	6	P 20 through P 25
327-X870000-29	Direct writer-recorder rack assembly	6870C	1	P 27
327-X150000-9	Oscillograph rack assembly	6150A	2	P 17, P 18
327-X160000-9	Maintenance rack	6160	1	P 03
327-X630011-9	FM/FM ground station No. 6, rack	6630A	1	P 04
327-X630011-19	FM/FM ground station No. 5, rack	6630B	1	P 05
327-X630011-29	FM/FM ground station No. 1 rack	6630C	1	P 06
327-X630011-39	FM/FM ground station No. 2 rack	6630D	1	P 07
327-X630011-49	FM/FM ground station No. 3 rack	6630E	1	P 08
327-X630011-59	FM/FM ground station No. 4 rack	6630F	1	P 09
327-X710000	Time and control rack assembly	6710	1	P 14

Part No.	Item	Control Point	Quantity	Location Spot No.
327-X180100-19	Ampex rack assembly (primary)	6180A	1	P 13
327-X210100-19	Ampex rack assembly (secondary)	6210A	1	P 12
327-X410000-9	RF rack No. 1	6410	1	P 01
327-X420000-9	RF rack No. 2	6420	1	P 02
(4) Roof Elevation of Walkway Tunnel				
424-6570000-9	Telemetry ground station receiving antenna	6570	1	--
(5) Approach Ramp and Launch Deck Area				
424-2081000	Instrumentation facility transducer installation	2081	1	--

7.8.2.6 GIE Cable Installation

7.8.2.6.1 Install the cables for the Ground Instrumentation Equipment in accordance with Drawing 424-6001000, Cabling, External, Launch Complex (modified), and 424-9501321, Block Cordage, AGE Instrumentation (Fig. 7-44).

Drawing 424-6001000 modifies the existing cabling as shown on Drawing 327-X001004. The cables shall be installed in existing cable trays. Modify existing cabling, install new cabling or use existing cabling between the areas and/or units shown in Table 7-4.

TABLE 7-4

Location and Category of Cabling

	Location	Category
(1)	Instrumentation equipment in blockhouse, second floor	Utilize existing cabling (Ref. Drawing 327-X001004)
(2)	Instrumentation, tunnel cabling	Utilize existing cabling (Ref. Drawing 327-X001004)
(3)	Instrumentation equipment, transfer room, first floor	Modified in accordance with Drawing 424-6001000 (modifications between CP 6690 to CP 6450 and CP 6400 to CP 6490)
(4)	Transfer room to umbilical tower for complete vehicle (these cables do not go to vehicle)	New cabling in accordance with Drawing 424-6001000
(5)	Transfer room to umbilical tower for test vehicle (these cables do not go to vehicle)	New cabling in accordance with Drawing 424-6001000
(6)	Transfer room to complete vehicle erector	New cabling in accordance with Drawing 424-600100

TABLE 7-4 (continued)

(7)	Transfer room to Stage II erector	New cabling in accordance with Drawing 424-6001000
(8)	Thrust mount I to transfer room	
	(a) Thrust mount to potting box (beneath mount)	Utilize existing cabling
	(b) Potting box to BLHAC (D2575) transfer room	New (Ref. Drawing 424-6001000)
	(c) Potting box to BLHDC (D2582) transfer room	New (Ref. Drawing 424-6001000)
	(d) BLHAC (D2575) to CP 4618, transfer room	Modified (Ref. Drawing 424-6001000)
	(e) BLH (D2582) to CP 4580, transfer room	Modified (Ref. Drawing 424-6001000)
(9)	Thrust mount II to transfer room	
	(a) Thrust mount to potting box (beneath mount)	Utilize existing cabling
	(b) Potting box to BLHAC (D2751) transfer room	New cabling (Ref. Drawing 424-6001000)
	(c) Potting box to BLHDC (D2744) transfer room	New cabling (Ref. Drawing 424-6001000)
	(d) BLHAC (D2751) transfer room to CP 4618, transfer room	Modified (Ref. Drawing 424-6001000)
	(e) BLHDC (D2744) transfer room to CP 4580, transfer room	Modified (Ref. Drawing 424-600100)
(10)	Umbilical connectors to transfer room	New cabling in accordance with Drawing 424-9501321
	(a) 2B1E umbilical connector to 2UB6 umbilical J-box	
	(b) 2B1E umbilical connector to CUB4 umbilical J-box	
	(c) 2B2E umbilical connector to CUB4 umbilical J-box	

TABLE 7-4 (continued)

(d) 2B2E umbilical connector to 2UB6 umbilical J-box

(e) 3B1E umbilical connector to 2UB5 umbilical J-box

(f) 3B1E umbilical connector to CUB3 umbilical J-box

(g) 3D1E umbilical connector to CUB1 umbilical J-box

(h) 2UB6 umbilical J-box to DRC1 transfer room

(i) 2UB6 umbilical J-box to DRL1 transfer room

(j) CUB4 umbilical J-box to DRC1 transfer room

(k) 2UB5 umbilical J-box to DRL1 transfer room

(l) CUB3 umbilical J box to DRL1 transfer room

(m) CUB1 umbilical J-box to DRL1 transfer room

(n) DRC1 transfer room to CP 6820 transfer room

(o) DRL1 transfer room to CP 6810 transfer room

(11) Other AGE to instrumentation equipment

(a) Approach ramp building

DC3 (first floor) to TBC1 (first floor)

DRC2 (first floor) to TBC2 (first floor)

PP2A (first floor) to TBC2 (first floor)

PDCS (CP 3730) (second floor) to TBC2 (first floor)

(b) Blockhouse to transfer room through tunnel

TBC1 transfer room to TBC1 blockhouse

TBC2 transfer room to TBC2 blockhouse

(c) Blockhouse first floor

TBC1 to DC2

TBC1 to TBL1

TBC1 to TBP1

DC2 to TBC2

TBP1 to TBC2

(d) Blockhouse first floor to second floor

TBC1 to PDCS, CP 3780

TBC1 to patch rack, CP 6500

TBC1 to patch rack, CP 6490

TBC3 to patch rack, CP 6490

TBC2 to patch rack, CP 6500

CP 4474, events control rack, to patch rack, CP 6500

TBP1 to patch rack, CP 6480

(e) Blockhouse second floor

CP 6480, patch rack, to CP 2500, propulsion control set

(12) Hangar T playback area — Utilize existing cabling (Ref. Drawing 327-X0060004)

7.8.3 Checkout Procedure

7.8.3.1 Visual Inspection

7.8.3.1.1 Visually inspect to verify that all equipment and cables have been properly installed and rigidly secured.

7.8.3.2 Functional Tests

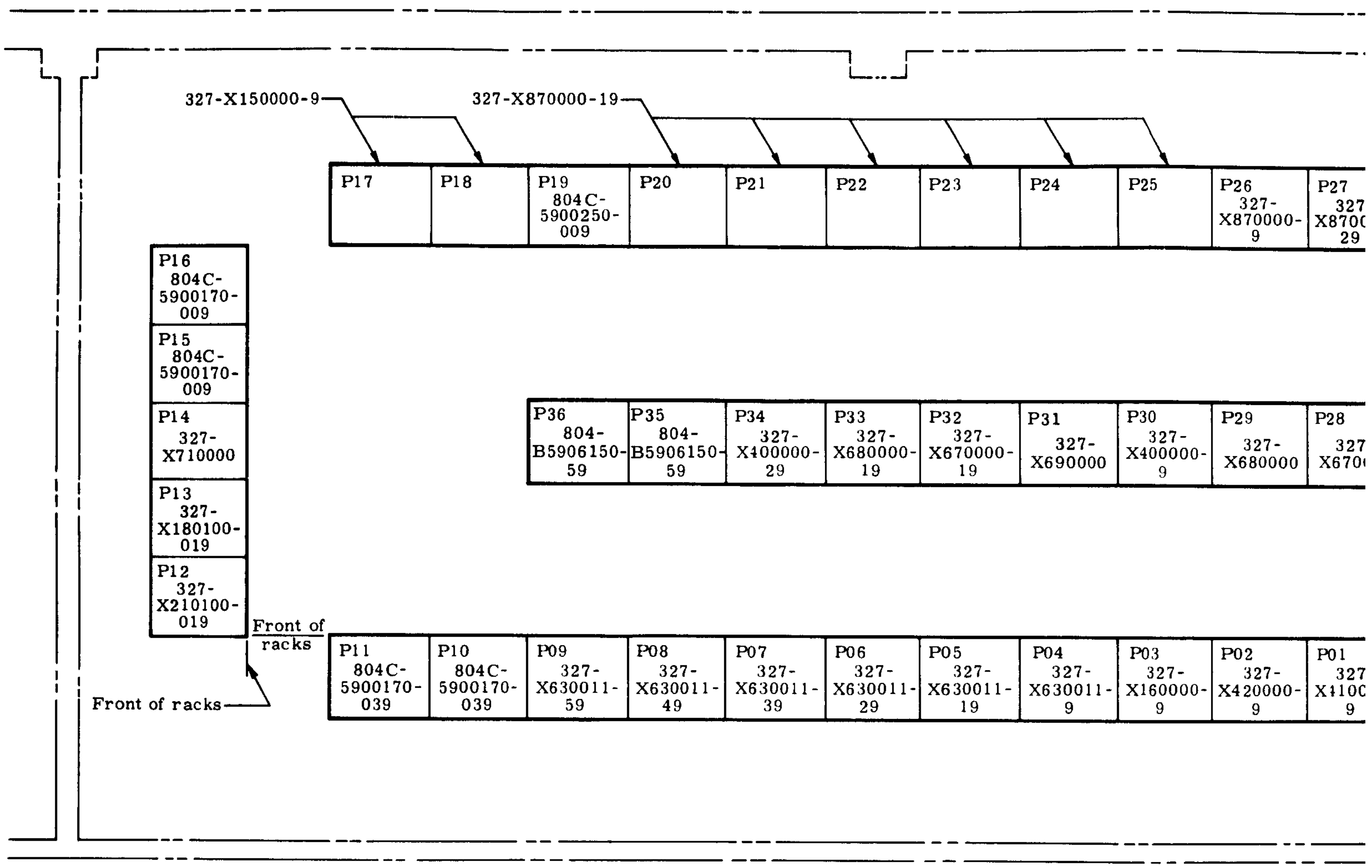
7.8.3.2.1 Conduct tests on the GIE in accordance with GSTP 424-1030/AMR, Ground Instrumentation.

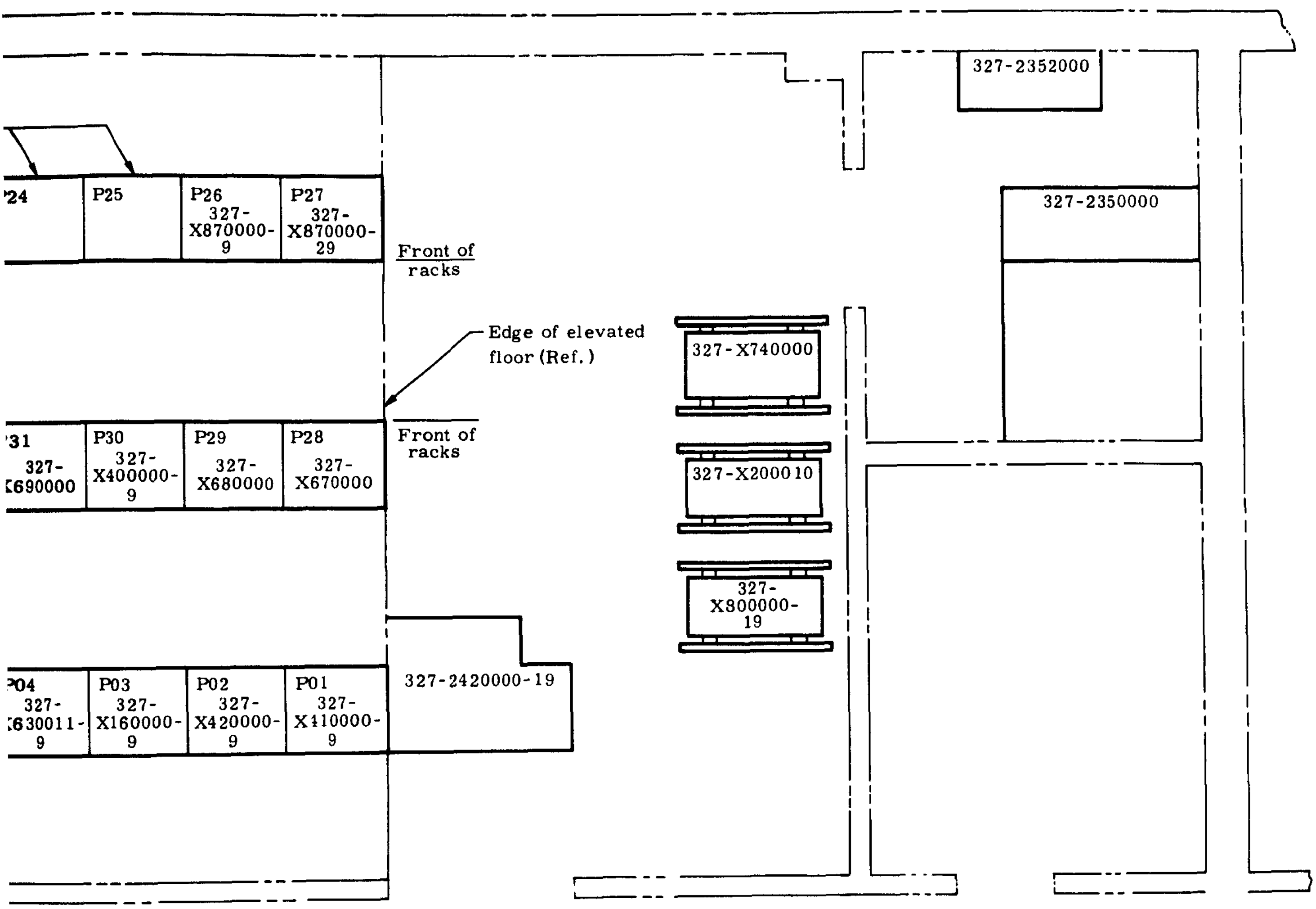
7.8.4 Documentation

Drawing No.	Title
424-2251000	AGE Installations, Blockhouse, Second Floor, Complex 19

Drawing No.	Title
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room, Approach Ramp Building, C-19
424-2152500	Equipment Installations, Upper Equipment Room, Approach Ramp Building, C-19
424-5000000	AGE Installations, Hangars T and U Complete, Industrial Area
424-2052000	AGE Installation, Approach Ramp and Launch Deck Complete
424-2081000	Transducer Assembly, Instrumentation
424-6000000	Ground Instrumentation Equipment
424-6001000	Cabling, External Launch Complex (modified) 327-X001004
424-9501321	Block Cordage, AGE Instrumentation
327-X001004	Cabling, External, Launch Complex
327-X006004	Cabling, External, Playback Area
424-1030/AMR	Ground System Test Procedure, Ground Instrumentation

1


327-X150000-9
327-X870000-19
P17
P18
P19 804C-5900250-009
P20
P21
P22
P23
P24
P25
P26 327-X870000-9
P27 327 X870 29
P16 804C-5900170-009
P15 804C-5900170-009
P14 327-X710000
P13 327-X180100-019
P12 327-X210100-019
P36 804-B5906150-59
P35 804-B5906150-59
P34 327-X400000-29
P33 327-X680000-19
P32 327-X670000-19
P31 327-X690000
P30 327-X400000-9
P29 327-X680000
P28 327 X670
Front of racks
Front of racks
P11 804C-5900170-039
P10 804C-5900170-039
P09 327-X630011-59
P08 327-X630011-49
P07 327-X630011-39
P06 327-X630011-29
P05 327-X630011-19
P04 327-X630011-9
P03 327-X160000-9
P02 327-X420000-9
P01 327 X410 9



2

Fig. 7-45. Plan View--Playback Area

7.9 TIME DISPLAY BOARD INSTALLATION (CP 4526)

7.9.1 Description

The time display board (Fig. 7-46), located above the TV monitors on the second floor of the blockhouse at Location 220, presents the following information to the Launch Director:

(1) Local time.

(2) Firing time.

(3) Time to go.

(4) Current hold time.

(5) Holding indication.

Initiation of current hold time and advance of firing time as a result of hold signal receipt is controlled by manual actuation of the current hold circuit. The time display board contains the following:

(1) Three wall clocks indicating current hold, firing time and local time.

(2) "Time-to-Go" indicator and circuitry.

(3) "Holding" indicator.

7.9.2 Sequence of Events

7.9.2.1 Time Display Board and Cabling Installation

7.9.2.1.1 Install the time display board (327-4526000) to the ceiling above the TV monitors on the second level of the blockhouse. The board is located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor.

7.9.2.1.2 Install and connect the cabling for the time display board in accordance with Drawing 424-9501030, Time Display Board Cable Wiring, and Drawing 424-2050300, Cable Set Installation, AGE. Following installation, the cabling shall be checked to verify compliance with 424-9501001.

AMR Cable Test Specification. Cable requirements are as follows:

(1) CP 4526, P15 to CP 4618 TBC3.

(2) CP 4526, TB2 to CP 4618 TBP1.

7.9.3 Checkout Procedure

Check out and verify operation by performing the requirements of Ground System Test Procedure 424-1031/AMR, Master Operations Control Set.

7.9.4 Documentation

Drawing No.	Title
424-2251000	AGE Installation, Blockhouse, Second Floor, Complex 19
327-4526000	Time Display Board
327-2051012	Time Display Board Installation, Blockhouse, Complex 19, AFMTC
424-9501030	Time Display Board Wiring
424-9501031	Time Display Board Block Cordage
424-1031/AMR	GSTP, AMR Master Operations Control Set
424-2050300	Cable Set Installation, AGE
424-9501001	AMR Cable Test Specification

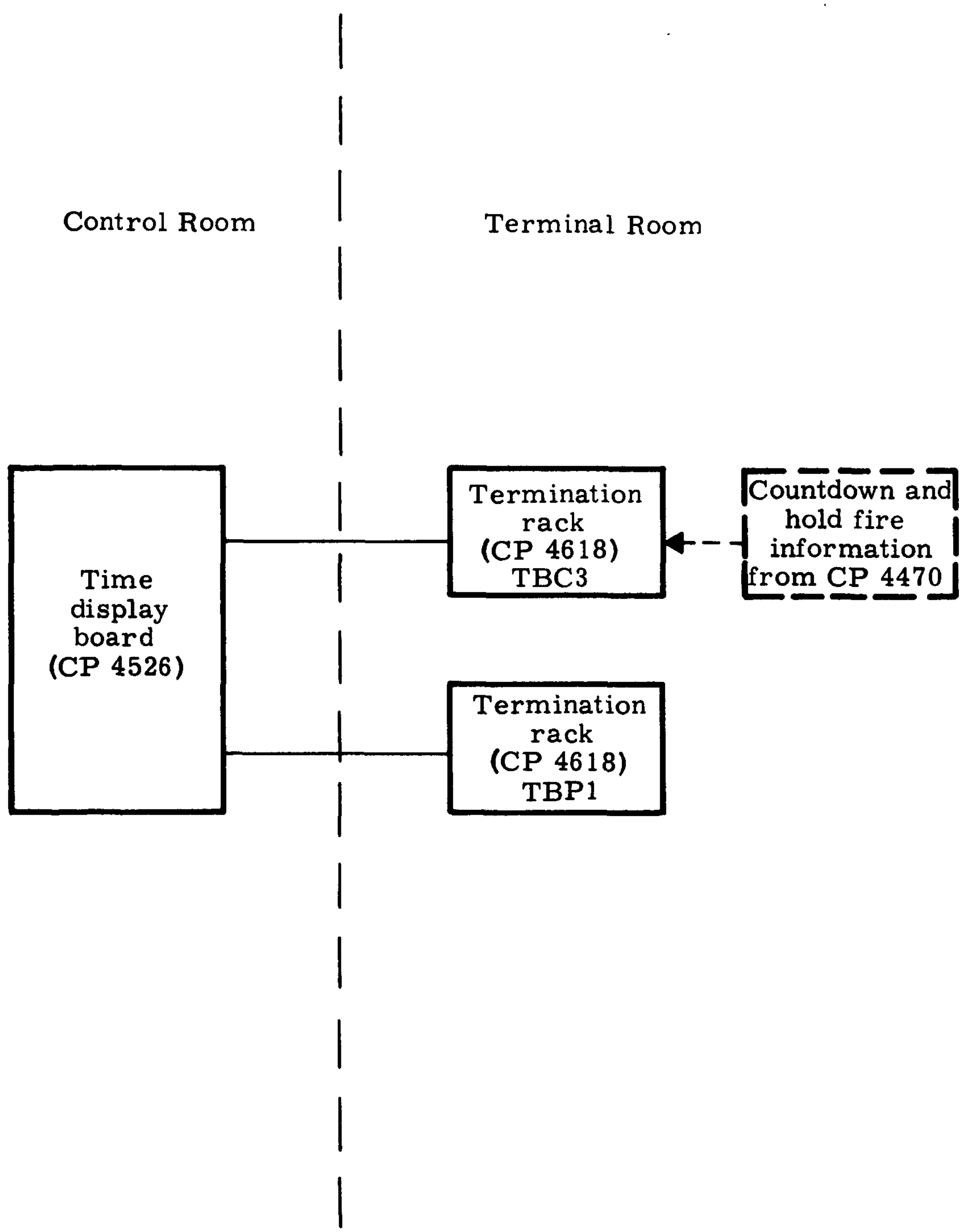


Fig. 7-46. Time Display Board (Blockhouse) CP 4526

7.10 PROPULSION CONTROL SET INSTALLATION (CP 2800)

7.10.1 Description

The Propulsion Control Set (PCS) (Fig. 7-47) is required to control and monitor the operation of the Launch Vehicle Propulsion System. The primary functions of this system are to select and indicate the proper mode of engine operation based on the phase of the launch or test operation; to perform tests prior to engine start, to set up initial conditions; to control engine starting and shutdown; to perform tests on engine operating parameters; to control post-engine shutdown operations; to provide for rocket engine purge and flush after static firing and provide for purge of turbopump gearbox cavities during static firing. The PCS (Fig. 7-47) consists of the following units:

(1) Propulsion control set rack No. 1 on blockhouse second floor (CP 2032) (Location 221).

(2) Propulsion control set rack No. 2 on approach ramp first floor (CP 2043) (Location 207).

(3) Propulsion control set indicator panel in blockhouse second floor (CP 2801) (Location 212) (part of CP 2021).

(4) Propulsion control set interconnecting cables.

(5) Shutdown purge units (280450-9, Aerojet-General Corporation) Stages I and II.

7.10.2 Sequence of Events

7.10.2.1 Propulsion Control Set Rack No. 1 Installation

7.10.2.1.1 Install the propulsion control set rack No. 1 (CP 2032) on the second floor of the blockhouse.

The unit shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse Second Floor, Complex 19.

7.10.2.2 Propulsion Control Set Rack No. 2 Installation

7.10.2.2.1 Install the propulsion control set rack No. 2 (CP 2043) in the transfer room located on the first floor of the approach ramp building.

The unit shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.10.2.3 Propulsion Control Set Indicator Panel Installation

7.10.2.3.1 Install the propulsion control set indicator panel (CP 2801) in the Propellant System control console (CP 2021) located on the second floor of the blockhouse.

The unit shall be located and installed in accordance with Drawing 424-2021000, Propellant System Control Console.

7.10.2.4 Shutdown Purge Unit Installation, Stages I and II (Launch Deck)

7.10.2.4.1 Install the two units in accordance with Drawing 424-2052000, AGE Installation, Approach Ramp and Launch Deck, Complete.

7.10.2.5 Propulsion Control Set Cabling Installation

7.10.2.5.1 Install the cables for the propulsion control set in accordance with Drawing 424-9501081, Block Cordage, Propulsion Control Set; Drawing 424-9501002, AMR Cable Installation Requirements; and Drawing 424-2050300, Cable Set Installation, AGE. The cables are installed in existing tunnel cable trays and the blockhouse and transfer room floor cable area.

The cables are installed between equipment as shown in Fig. 7-47. The cables must be checked out in accordance with AMR Cable Test Specification 424-9501001 prior to conducting functional tests.

7.10.3 Checkout Procedure

7.10.3.1 Functional Test

7.10.3.1.1 Conduct tests in accordance with 424-1026/AMR, Ground System Test Procedure, Propulsion Control Set. These tests have, as objectives, the verification of the following functions:

(1) The control and monitoring of the Launch Vehicle Propulsion System.

(2) The proper mode of engine operation for combined system test, flight readiness firing, sequential compatibility firing and launch.

(3) The control of Stages I and II prevalves

(4) The control of the engine start cartridges.

(5) The monitoring of a selected group of critical engine parameters for automatic engine shutdown in event of a malfunction.

(6) Shutdown control of Stage I and Stage II engines.

(7) The display of information received or internally generated as related to the progress of the firing sequence.

7.10.4 Documentation

Document No.	Title
424-2251000	AGE Installation, Blockhouse Second Floor, Complex 19
424-2800000	Propulsion Control Set
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2021000	Propellant System Control Console
424-2053000	Cable Set Installation, AGE
424-9501081	Block Cordage, Propulsion Control Set
424-9501002	AMR Cable Set Installation
424-9501001	AMR Cable Test Specification
424-1026/AMR	Ground System Test Procedure, Propulsion Control Set
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete

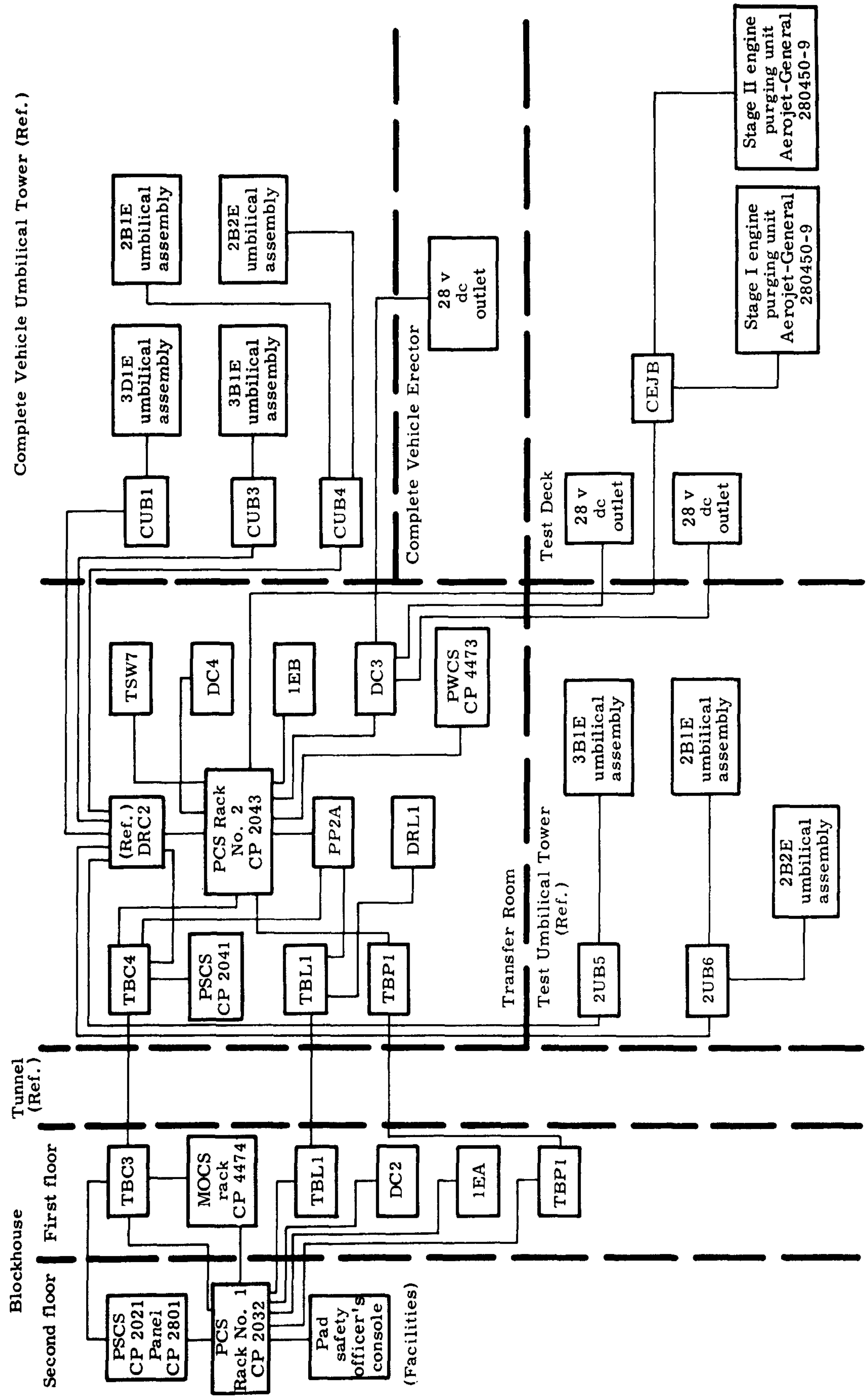


Fig. 7-47. Propulsion Control Set Cabling

7.11 LAUNCH VEHICLE SAFETY SYSTEM TEST SET INSTALLATION (CP 2850)

7.11.1 Description

The Launch Vehicle Safety System Test Set (LVSSTS) provides for the control, monitor, checkout and operation of the Launch Vehicle Range Safety System. The LVSSTS (Figs. 7-48 and 7-49) controls, monitors and tests the two command receivers, the shutdown and destruct command reactions, the destruct initiators and the Stage I inadvertent stage separation destruct capability. In addition, the MISTRAM transponder is controlled, monitored and checked out by the LVSSTS. A receiver is provided within this test set for the monitoring of carrier and/or command transmissions originated by the range safety transmitter. The LVSSTS consists of the following units:

(1) Launch vehicle safety system test set in blockhouse second floor (CP 2030, Location 222).

(2) Command receiver control-monitor group rack (CP 2020, Location 223).

(3) MISTRAM tracking rack in approach ramp building second floor (CP 2025 Location 510).

(4) LVSSTS cabling and interconnections.

7.11.2 Sequence of Events

7.11.2.1 LVSSTS Rack Installation

7.11.2.1.1 Install the launch vehicle safety system test rack, 424-2030000, on the second floor of the blockhouse. The rack shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.11.2.2 Command Receiver Control-Monitor Group Rack Installation

7.11.2.2.1 Install command receiver control-monitor group rack, 424-2020000, on the second floor of the blockhouse. The rack shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.11.2.3 MISTRAM Tracking Rack Installation

7.11.2.3.1 Install MISTRAM tracking rack, 424-2025000, on the second floor of the approach ramp building. This rack, containing the MISTRAM test set, shall be located and installed in accordance with Drawing 424-2152500, Equipment Installation, Upper Equipment Room, Approach Ramp Building, Complex 19.

7.11.2.4 LVSSTS Cabling Installation

7.11.2.4.1 Install and connect cabling for the LVSSTS in accordance with Drawings 424-9501070, Cabling and Interconnection, LVSSTS; and 424-2050300, Cable Set Installation, AGE. The cables are installed between the equipment shown in Fig. 7-49.

Installation of cabling between distribution rack DRC2 and the launch and test positions is contained in Section 7-1; installation of DRC2 is covered in Section 7-4.

As shown in Fig. 7-48, coaxial cabling and wave guides are required. Installation of this equipment is not included here but is provided by the RF transmission system installation plan. For details relative to this installation, refer to Drawings 424-5791025, Command Control RF System, AMR and 424-5791026, MISTRAM RF System, AMR.

The PP2A cable set transition rack (part of CP 9501) contains a patchboard that permits testing of either the complete Gemini launch vehicle or Stage II only. This patchboard must be manually positioned to coincide with the desired test setup. These cables, plus those mentioned in the two preceding paragraphs must be installed and checked out in accordance with 424-9501001, AMR Cable Test Specification, prior to conducting functional tests.

7.11.3 Checkout Procedure

7.11.3.1 Functional Test

7.11.3.1.1 Conduct tests on the LVSSTS in accordance with GSTP 424-1027/AMR, Launch Vehicle Ordnance and Range Safety. Test objectives are verification of the following:

(1) Proper operation of RF transmission lines and wave guide assemblies without excessive losses or attenuation.

(2) Correct installation of interconnecting wiring between ground and launch vehicle components.

(3) Proper MOCS holdfire and function circuit connections.

(4) Proper RF output from ground equipment.

7.11.4 Documentation

Document No.	Title
424-2020000	Command Receiver, Control-Monitor Group Rack
424-2025000	MISTRAM Tracking Rack
424-2030000	Launch Vehicle Safety System Test Console
424-2152500	Equipment Installation, Upper Equipment Room, Approach Ramp Building, Complex 19
424-2251000	AGE Installation, Blockhouse, Second Floor, Complex 19
424-5791025	Command Control RF System, AMR
424-5791026	MISTRAM RF System, AMR
424-9501001	AMR Cable Test Specifications
424-9501070	Cabling and Interconnections, LVSSTS
424-9501310	Transfer Room Cable Set
424-9501460	Umbilical Cables
424-1027/AMR	Ground System Test Procedure, Launch Vehicle Ordnance and Range Safety

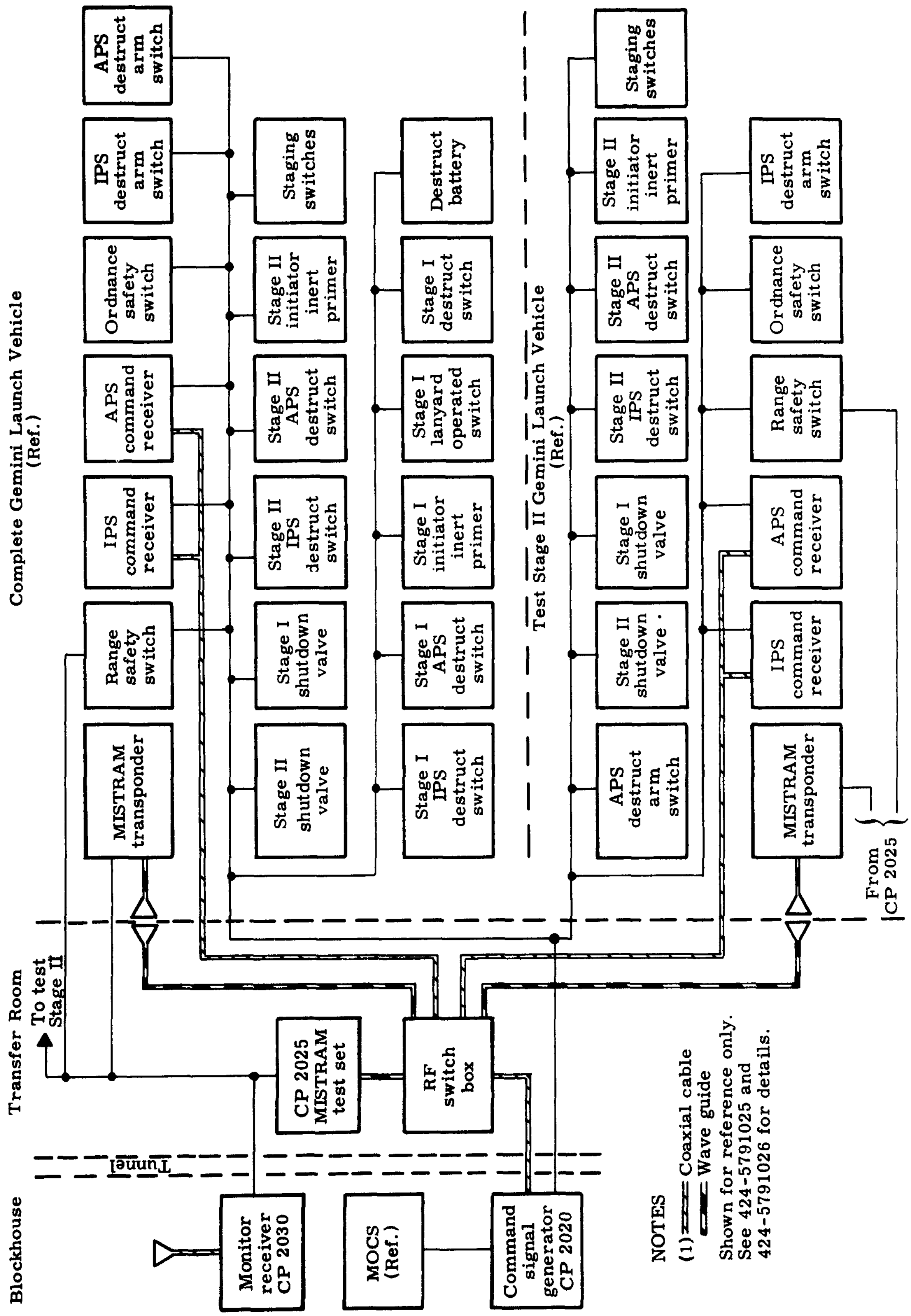
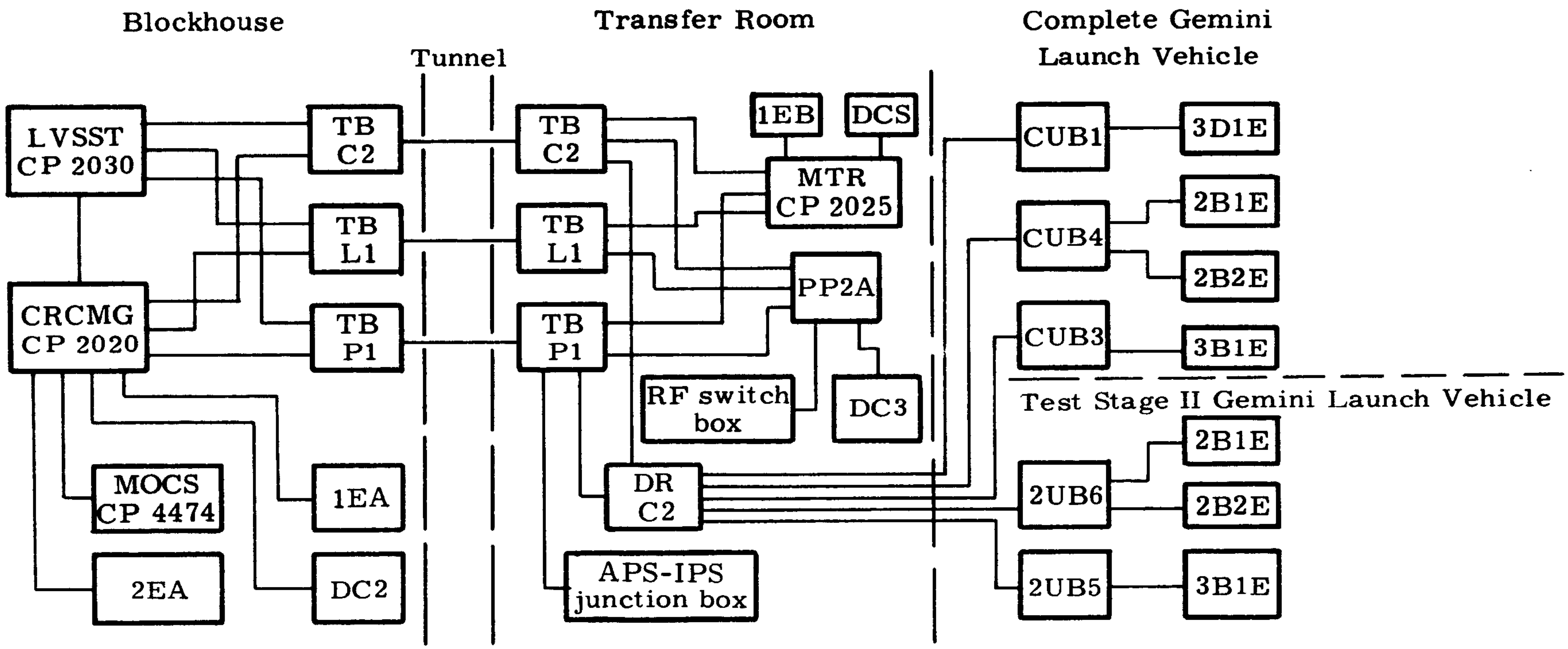


Fig. 7-48. LVSSTS and Associated Equipment



NOTE: (1) See detailed block diagram for coaxial and wave guide interconnection. Run is shown for reference only.

(2) Cabling between DRC2 and umbilical junction box is shown for reference only. See Drawing 424-9501310 for wiring details.

(3) Cabling between umbilical junction box and umbilical plugs is shown for reference only. See Drawing 424-9501460 for wiring details.

Fig. 7-49. LVSSTS Cabling

7.12 CLOSED CIRCUIT TELEVISION SYSTEM INSTALLATION

7.12.1 Description

The Closed Circuit Television (CCTV) System is used for visual monitoring during sequenced compatibility firings, flight readiness firings, launch, propellant loading operations, subsequent periods after test firings, and for spill monitoring and external spacecraft monitoring (Fig. 7-50). The CCTV system includes six camera pads. The camera pad equipment consists of a tower assembly, a pan-tilt unit and a waterproof housing (Fig. 7-51). The tower assembly is supported by a circular base plate anchored by sand screws; guy wires are anchored also by sand screws. A removable-step work platform is provided for the tower assembly. The weatherproof housing contains the camera and an auto-zoom lens. Located in the blockhouse are the CCTV remote control panels (Locations 254 and 255), CCTV master monitor console (Location 201), CCTV master monitor (Locations 214 through 219), and the slave monitor console (Locations 227 through 232, eight racks bolted together) (Fig. 7-52). The CCTV remote control console contains two flush-mounted control panels, the master control panel which contains all operating controls for the system exclusive of power, and the power-intercommunication panel which contains the power control circuits and CCTV channel intercommunications circuits. Internal observation of the spacecraft white room and other spacecraft observations will be accomplished with a CCTV system, furnished by the Spacecraft Contractor.

7.12.2 Sequence of Events

Utilize all existing hardware and equipment except for the following modified equipment locations and related parts.

7.12.2.1 CCTV Cable Installation

7.12.2.1.1 Install CCTV cables from the old locations of stub-ups Nos. 1 and 6 through the new facility conduit to the new locations in accordance with Drawing 424-2050200, CCTV System Installation.

7.12.2.2 Camera No. 1 Erection

7.12.2.2.1 Erect CCTV tower No. 1 in line of sight of Gemini launch vehicle umbilical connections and Stage II flame bucket using guy wires and sand screws to secure it firmly.

7.12.2.2.2 Install work platform.

7.12.2.2.3 Install pan-tilt unit and weatherproof housing.

7.12.2.2.4 Connect cables between stub-up box No. 1 and pan-tilt/weatherproof housing.

7.12.2.3 Camera No. 6 Erection

7.12.2.3.1 Erect CCTV tower No. 6 in line of sight of Stage I flame bucket using guy wires and sand screws to secure it firmly.

7.12.2.3.2 Install work platform.

7.12.2.3.3 Install pan-tilt unit and weatherproof housing.

7.12.2.3.4 Connect cables between stub-up box No. 6 and pan-tilt/weatherproof housing.

7.12.2.3.5 CCTV camera pads Nos. 1 and 6 may be repositioned anywhere within the designated area of 424-2050200 and 424-1750003.

7.12.2.4 Panels and Cabling Installation

7.12.2.4.1 Install CCTV remote control panels, CCTV master monitor console (group of six racks), slave monitor console (group of six racks), master monitors and cabling in accordance with 424-2050200 and 424-2251000, Installations, Blockhouse, Second Floor, Complex 19.

7.12.3 Checkout Procedure

7.12.3.1 Test Objectives

Tests are performed to verify nighttime picture quality on the master and slave monitors, remote control of picture quality parameters and camera functions.

7.12.3.2 Functional Test

A brief description of the checkout procedure, which is detailed in Ground Systems Test Procedure 424-1045/AMR.

7.12.3.2.1 Check out cameras Nos. 1 through 6:

(1) Establish initial control settings and switch positions and switch power on.

(2) Check synchronizer generator at master monitor console.

(3) Check beam and contrast controls, camera movements, focus, iris, and zoom controls.

(4) Perform insufficient and excessive beam tests.

(5) Perform insufficient and excessive target tests.

(6) Perform insufficient light tests.

(7) Perform video input and video gain tests.

(8) Check contrast and brightness controls on slave monitors.

(9) Check camera weatherproof housing blower motor and windshield wiper.

7.12.4 Documentation

Document No.	Title
424-2050200	CCTV System Installation
424-2251000	AGE Installations, Blockhouse, Second Floor, Complex 19
Drawing E-5, Rader	Communications, TV Camera, Site Plan
424-1045/AMR	Ground System Test Procedure, Closed Circuit TV

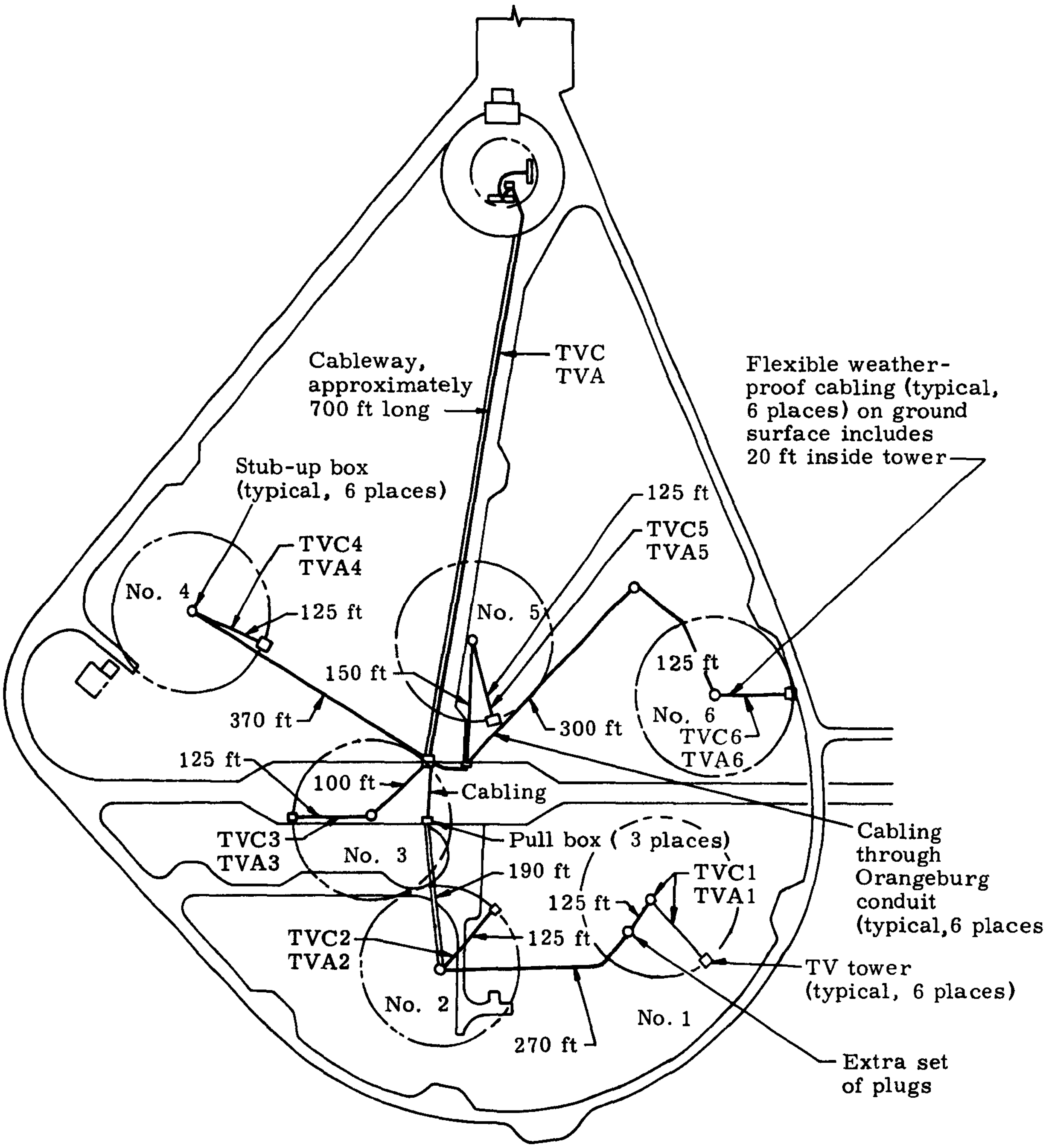


Fig. 7-50. CCTV Tower Cable Routing

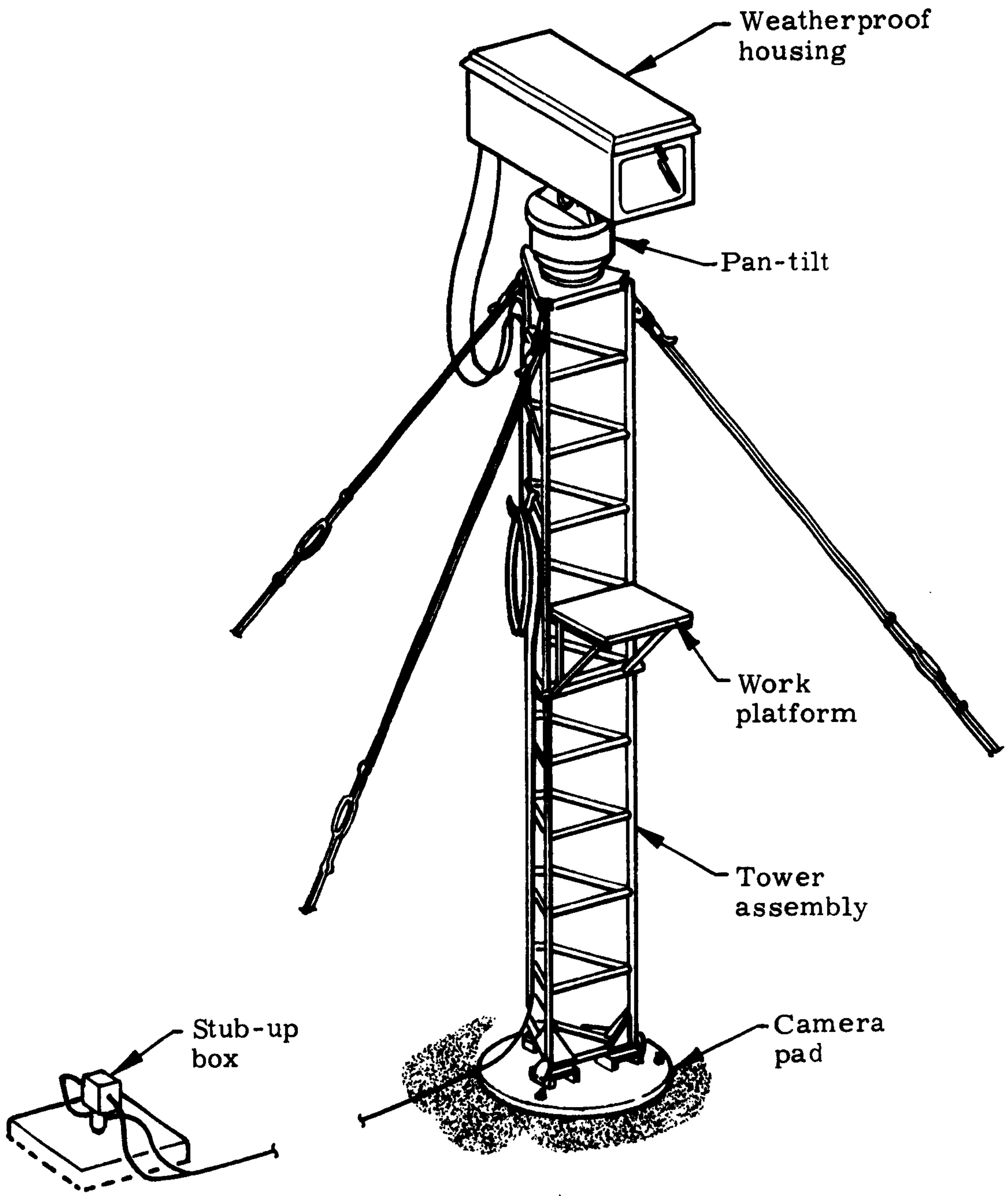


Fig. 7-51. CCTV Tower Assembly

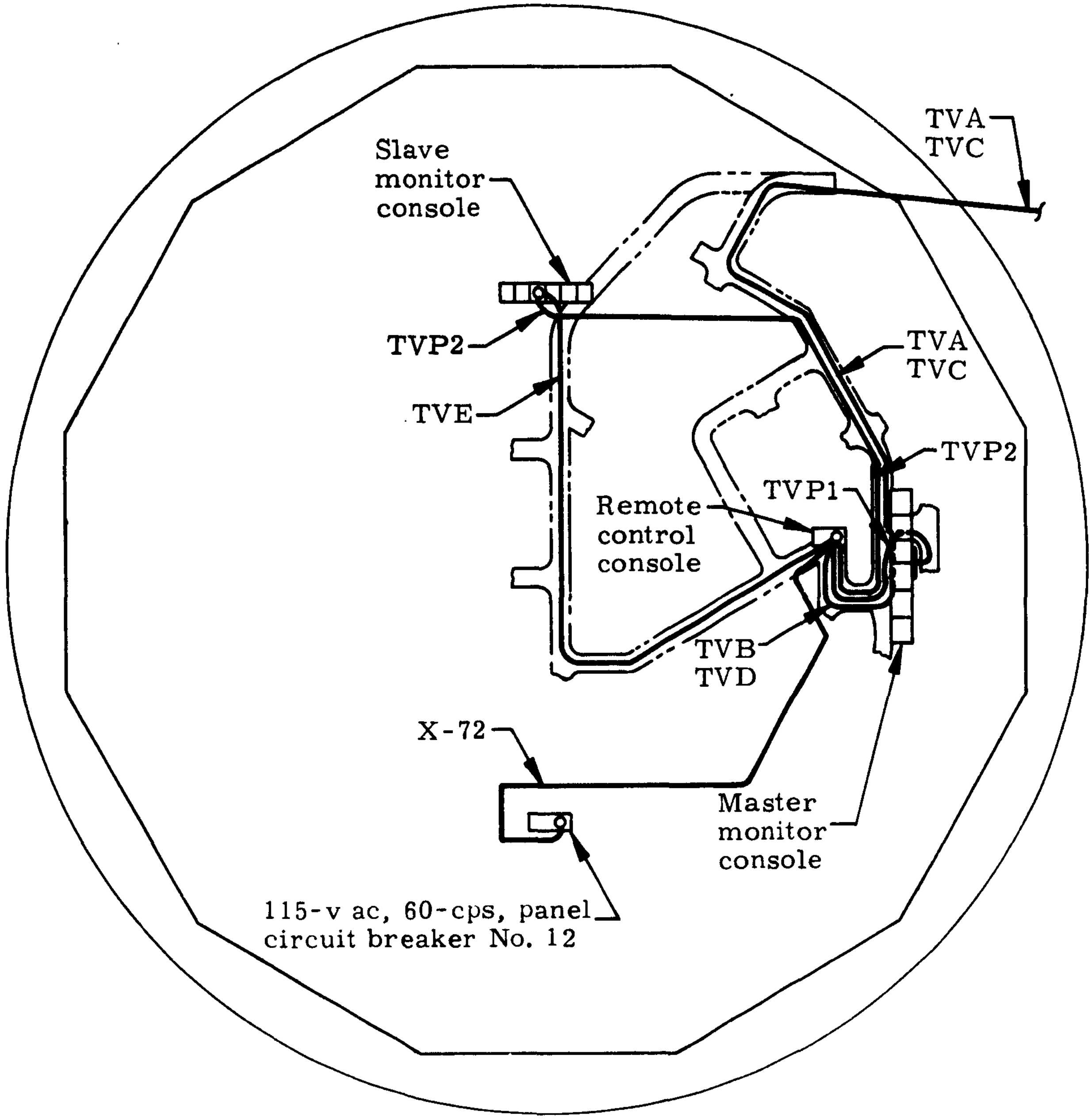


Fig. 7-52. Blockhouse Cable Routing

7.13 MALFUNCTION DETECTION SYSTEM TEST SET INSTALLATION (CP 3400)

7.13.1 Description

The Malfunction Detection System Test Set (MDSTS) performs prelaunch checkout and launch countdown monitoring of the Malfunction Detection System (MDS). Portions of the MDS tests are accomplished prior to application of launch vehicle power; other portions are accomplished with launch vehicle power present but without the tanks pressurized. The remaining portions are performed with launch vehicle power present and with the tanks pressurized.

The MDSTS accomplishes checkout in two basic phases. The first phase, performed manually, is termed the checkout mode and confirms the following MDS parameters:

(1) Spin Motor Rotation (SMR) and rate switch operation in the pitch, yaw and roll overrate circuits.

(2) Stages I and II engine chamber underpressure sensor switch verification.

(3) Staging command signal and stage separation signal verification.

(4) Launch vehicle shutdown switch verification.

(5) Shutdown lockout timer verification.

(6) Stages I and II fuel and oxidizer tank underpressure analog sensor verification.

The second phase, the prelaunch mode, is a period wherein specified MDS parameters are monitored continuously. In the prelaunch mode, the MDSTS has an automatic capability for this continuous monitoring and is capable of generating a hold or kill signal.

The MDSTS consists of the following equipment:

(1) MDSTS console (CP 3410) Location 226.

(2) MDSTS rack (CP 3420) Location 41.

(3) MDS cable set.

7.13.2 Sequence of Events

7.13.2.1 MDSTS Console Installation

7.13.2.1.1 Install 424-3410000, MDSTS console, in the control room on the second floor of the Blockhouse. This console shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.13.2.2 MDSTS Rack Installation

7.13.2.2.1 Install 424-3420000, MDSTS rack, in the transfer room of the approach ramp building. This unit shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.13.2.3 MDSTS Cabling Installation

7.13.2.3.1 Install and connect cabling (Fig. 7-53) for the MDSTS in accordance with Drawings 424-9501130, MDSTS Cable Set, and 424-2050300, Cable Set Installation AGE. Following installation, cables should be checked to verify compliance with 424-9501001, AMR Cable Test Specification. Cabling is provided between the locations shown in Fig. 7-53.

7.13.3 Checkout Procedure

7.13.3.1 Functional Test

7.13.3.1.1 Conduct tests on the MDSTS in accordance with 424-1028/AMR, Malfunction Detection System Test Set. The following objectives are to be accomplished:

(1) Demonstrate the self-verification capability of the MDSTS.

(2) Demonstrate the operation of the MDSTS in the manual or checkout mode.

(3) Demonstrate the operation of the MDSTS in the automatic or launch mode and verify a hold and kill signal to the MOCS in the presence of any simulated malfunction.

7.13.4 Documentation

424-2050300	Cable Set Installation, AGE
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2251000	AGE Installation, Blockhouse, Second Floor, Complex 19
424-3410000	Malfunction Detection System Test Console
424-3420000	Malfunction Detection System Test Rack
424-9501001	AMR Cable Set Test Specification
424-9501130	MDSTS Cable Set
424-1028/AMR	Malfunction Detection System Test Set

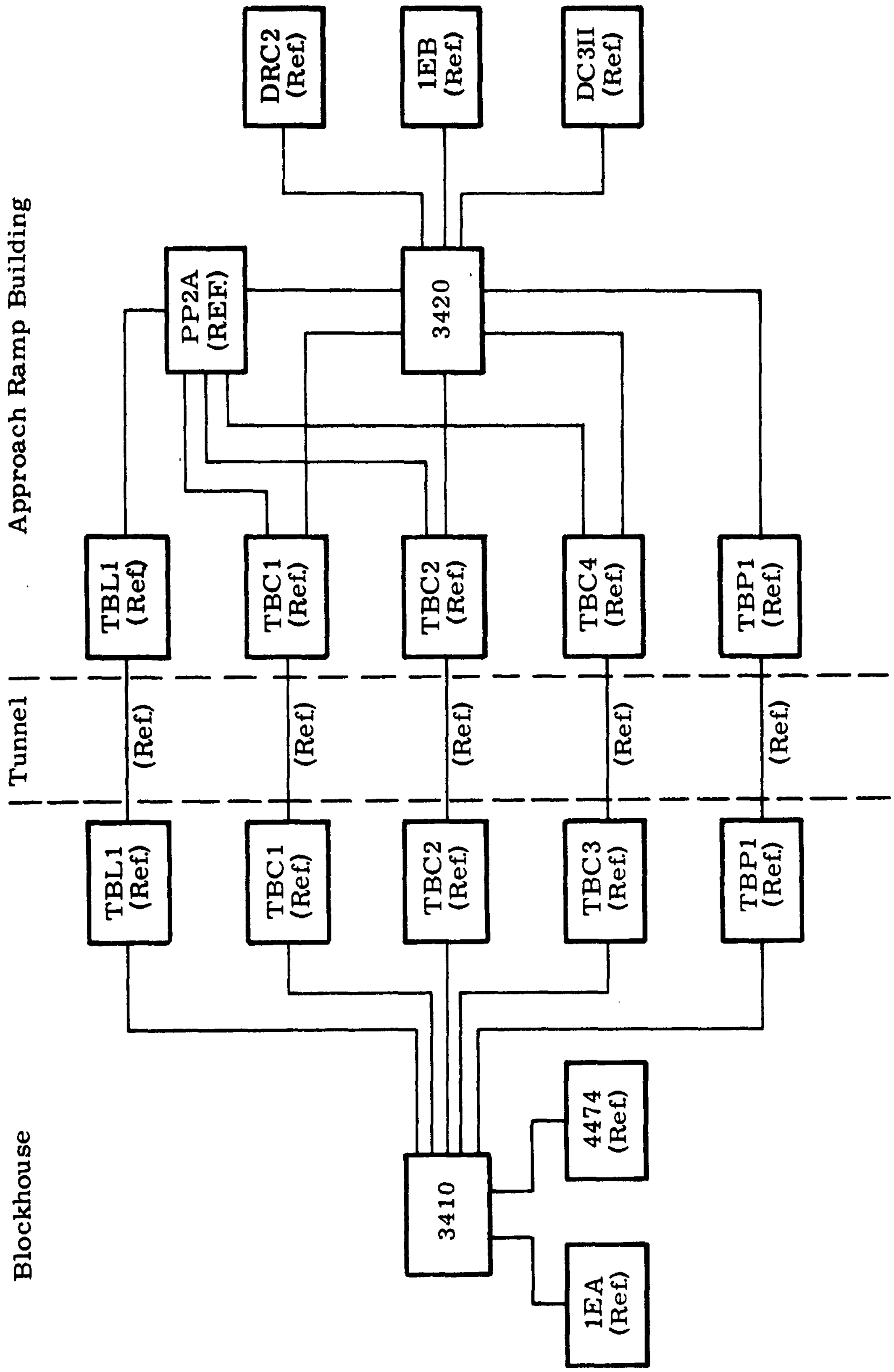


Fig. 7-53. Malfunction Detection System Test Set Cabling

7.14 AIRBORNE BEACON EQUIPMENT TEST SET INSTALLATION

7.14.1 Description

The Airborne Beacon Equipment Test Set (ABETS), CP 9595, is used to test the General Electric Mod IIIG Radio Guidance Set in the launch vehicle (Fig. 7-54). The ABETS unit (CP 9595B) is located in the upper equipment room of the approach ramp building. A remote control monitor rack (CP 9595A) is located in the control room of the blockhouse.

Testing is accomplished by interrogation of the airborne systems and measurement of voltage potentials, pitch/yaw and discrete relay closures. The RF Transmission System, described in paragraph 7.22, provides an RF connection between the ABETS unit and the Mod IIIG Radio Guidance Set.

The ABETS consists of the following units:

(1) ABETS rack (CP 9595B)

(2) ABETS remote monitor rack (CP 9595A)

(3) General Electric Radio Guidance System cabling and interconnections.

7.14.2 Sequence of Events

7.14.2.1 ABETS Rack Installation

7.14.2.1.1 Utilize existing tunnel cabling. For details, refer to the tunnel wiring and umbilical wiring installation plan.

Cabling to connect patch rack PP2A to the distribution racks and to the complete launch vehicle position and the Stage II test position is not included in General Electric Radio Guidance System cabling. For details, refer to Drawings 424-9501310, Transfer Room Cable Set, and 424-9501460, Umbilical Cables. Patch rack PP2A, installed as part of the Electric Power System, contains a manually positioned patchboard that permits testing at either the complete vehicle position or the Stage II position.

7.14.2.1.2 Install ABETS rack (CP 9595B) in the upper equipment room of the approach ramp building (Location 432).

7.14.2.2 Remote Monitor Rack Installation

7.14.2.2.1 Install remote monitor rack (CP 9595A) in the control room of the blockhouse (Location 207) in accordance with Drawing 424-2251000, AGE Installation, Blockhouse Second Floor, Complex 19.

7.14.2.3 ABETS Cabling Installation

7.14.2.3.1 Install and connect cabling for the ABETS in accordance with Drawing 424-9501060, Cabling and Interconnections, General Electric Radio Guidance System.

7.14.3 Checkout Procedure

7.14.3.1 Functional Test

7.14.3.1.1 Test the electrical cabinet and the remote unit of the ABETS in accordance with Test Procedure 424-386/AMR, Guidance System Countdown Preparation, and Ground Systems Test Procedure 424-1046/AMR, General Electric Radio Guidance System:

(1) Verify the proper operation of the decoder test set in the approach ramp building rack.

(2) Verify the proper operation of the pulse beacon test section and the rate beacon test section of the beacon test set in the approach ramp building.

(3) Verify the proper operation of the remote beacon test panel in the blockhouse rack.

(4) Verify the proper operation of the manual hold-kill circuitry.

(5) Verify the proper operation of the airborne power control circuitry.

NOTE: These tests also serve to verify a portion of the RF Transmission System.

1.14.4 Documentation

Document No.	Title
[illegible]	Equipment Installation, Upper Equipment Room, Approach Ramp Building, Complex 19
[illegible]	AGE Installation, Blockhouse Second Floor, Complex 19
424-9501660	Cabling and Interconnections, General Electric Guidance System
424-9501661	Block Cordage, General Electric Guidance
424-9501310	Transfer Room Cable Set
424-9501460	Umbilical Cables
424-9595000	Airborne Beacon Equipment Test Set
424-386/AMR	Test Procedure, Guidance System Countdown Preparation
424-1046/AMR	GSTP, General Electric Radio Guidance

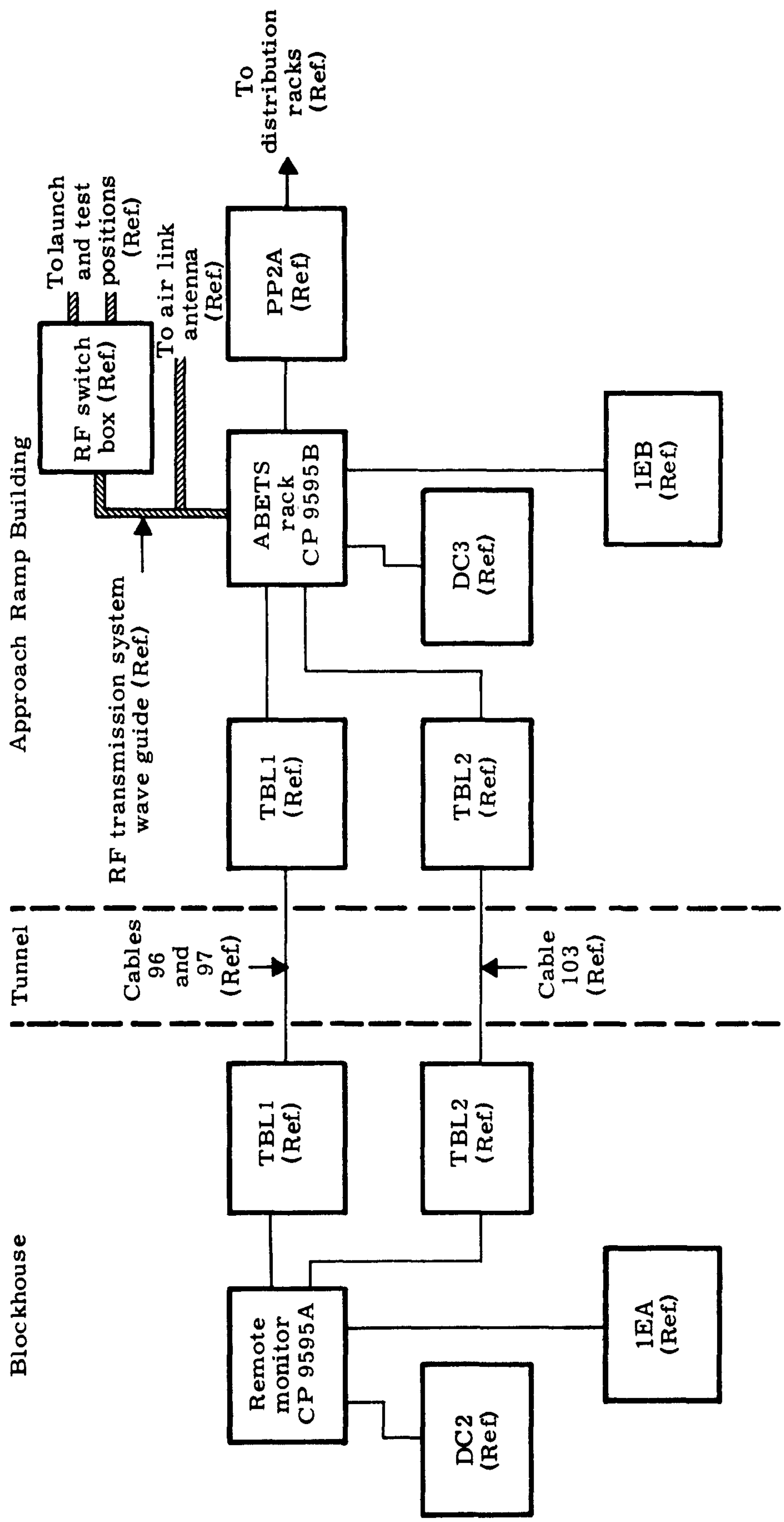


Fig. 7-54. Airborne Beacon Equipment Test Set Cabling

7.15 ERECTOR WORK PLATFORM INSTALLATION

7.15.1 Description

Folding work platforms are provided to bridge the gap between the complete vehicle erector fixed working platforms and the launch vehicle and spacecraft, and between the Stage II erector fixed working platforms and Stage II. These platforms fold so that the vehicle trailer, with its stage, can enter into the applicable erector during horizontal loading. When these platforms are folded, the erector can be raised or lowered with the stages in place on their thrust mounts.

When in the closed position, the platforms provide access to work areas around the vehicle, provide support for checkout equipment, support the spacecraft while in the elevated position, seal the bottom of the spacecraft protective enclosure, and provide means to support weather protective curtains and barricades where required.

Each platform, fabricated of aluminum, consists of four or five segments, each operated by hydraulic actuators controlled at the platform level. The platform segments are hinged at the erector structure and can be folded either up or down, depending on clearance requirements. In addition, a number of platform segments are designed to double fold or to have removable insert panels for the same reason. Position of the platforms is determined visually.

Platform loads are transmitted to the erector structure at the hinge locations and through struts which operate with the platforms.

The locations of folding platforms, their general segmented arrangement, and the means by which they are positioned are shown in Figs. 7-55 through 7-61.

Folding platform installations are made with the erectors in the "down" position, while adjustments and checkout are accomplished when the erectors are in the "up" position.

Since folding platform installation procedures at each level are similar (except at elevation 9 feet 8 inches) the description of the installation at the 35-foot, 4-3/16-inch elevation is typical of all elevations. The total number of segments at a given elevation will vary and the assembly and installation drawing numbers are different because of minor variations from elevation to elevation.

7.15.2 Sequence of Events

7.15.2.1 Establishing of Vehicle Plumb Lines on Erectors

7.15.2.1.1 Establish vehicle plumb lines on the erector structures, utilizing Figs. 7-55 and 7-56 for reference.

(1) With the erectors in the "up" position, establish the vehicle centerline on the structural members to which the hinged platforms attach. These lines represent the vertical centerline of the vehicle in two planes as it will be positioned on the thrust mounts.

(2) Establish plumb lines for all platform positions.

7.15.2.2 Positioning and Alignment of Platform Segments and Associated Hardware at 35-Foot 4-3/16-Inch Elevation

7.15.2.2.1 Install rear segment, platform assembly, 804C9170413-029.

(1) Align segment deck plate with the fixed platform and position the segment in accordance with the installation drawing.

(2) Shim hinge brackets at the erector structure to assure proper hinge action without binding.

(3) Clamp the hinges to the structure to establish a temporary fixed position.

7.15.2.2.2 Install the strut and actuator support (Fig. 7-61) between the I-beam supports of the transtainer tracks and temporarily bolt in place.

(1) Install the actuator cylinder and the strut between the fittings provided on the platform assembly (Part No. 804C9170413-029) and the support (Part No. 327-4770824-009) in accordance with Drawing No. 804B9170113-019), Work Platform Installation.

7.15.2.2.3 Install platform assemblies 804C9170413-009, 327-4770752-10, 804C9170417-009 and 804C9170412-009, in that order, in accordance with Drawing 804B9170113-019, Work Platform Installation.

(1) Establish proper clearances, shim hinge brackets as required, and clamp the hinge brackets to the structure for each of the four platform assemblies.

7.15.2.2.4 After positioning each segment, install the actuator arms and brackets and the actuators to the segment and to the erector structure.

7.15.2.2.5 Install forward platform segment tension struts (see platform installation drawings), but do not attach to the erector structure until actuators are adjusted after the erector is moved to the vertical position.

7.15.2.2.6 Tack-weld those hinge brackets which attach to the steel structure of the erector after determining that the deck plates are on a common plane with the appropriate fixed platform.

NOTE: The hydraulic lines for each actuator are installed in Section 7.3.

7.15.2.3 Installation of Remainder of Work Platforms

7.15.2.3.1 Install platforms at all remaining elevations on the Complete Vehicle Erector (CVE) and Second Stage Erector (SSE) in conformance with referenced installation drawings, and the procedures outlined in paragraph 7.15.2.

NOTE: Since the spacecraft section of the complete vehicle erector is of structural aluminum, fixing the position of the hinge brackets before the erector is raised will require that each hinge be temporarily bolted in place while the erector is in the "down" position.

7.15.2.3.2 Install the folding platform adapter sections at an elevation of 38 feet 6-5/16 inches (SSE) which attach to the folding platform segments after their installation. The adapters provide a platform surface with a smaller opening around the smaller diameter transition section (Fig. 7-61). Install these adapters prior to the platform segment adjustment.

7.15.2.3.3 Adjustments

(1) Adjust the travel of the platforms for clearance requirements and levelness, using the hydraulic system and its associated manual control valves.

(a) Move the erector to the vertical position and adjust the actuators to assure platform levelness in the "working" position and proper throw for vehicle clearance in the "stowed" position.

Make initial adjustment without hydraulic pressure.

NOTE: Where platform segments fold "down" at elevations of 60 feet, 6 inches and 70 feet, 6 inches (CVE) and 20 feet, 5/16 inch (SSE), each hydraulic actuator is fully open when the related segment is in its level position and the operating rod is retracted to open the segment. Installation procedures are identical for these segments; however, during adjustment, the actuator is pressurized to extend the rod to establish the "level" platform condition.

To permit central rear segment adjustment, the strut and actuator support end attachment brackets have been provided with elongated bolt holes, and the hydraulic actuator and the telescoping strut are adjustable in length.

(2) After leveling the platform segment using these adjustable items, fix the position of the strut and actuator support by welding.

(3) Fix the closed length of the actuator by drilling a hole and installing a lock pin through the male and female components of actuator rod.

(4) Fix the length of the strut by welding the clevis pin connecting eye to the telescoping tube after the male segment length is adjusted to bottom in the female segment.

(5) Position the remaining platform segments at each level by adjusting the actuator bracket with slotted bolt holes and by changing the length of the hydraulic actuator rod.

(6) Fix the bracket in position by drilling and bolting through the bracket to the erector structure.

(7) Establish the length of the hydraulic actuator rod as outlined previously.

NOTE: During adjustment of these segments, the actuators are operated before "fixing" operating positions to assure satisfactory clearances between the launch vehicle and the folding platforms.

When actuators are used to open the platform, all hinges are checked for binding, and the stroke of the actuator cylinder is given a final check. (Platform installation drawings set forth the required stroke.)

Actuator brackets in the spacecraft area are mounted to the structure after facility construction work is completed. They are dimensionally located in a fixed position and are not adjustable. In adjusting platform segments at these elevations, only actuator rod adjustments are possible.

7.15.2.4 Final Platform Hinge Installation

7.15.2.4.1 Weld hinge backup plates in the erector structural steel section to the erector structure and drill the hinge attachment bolt holes to permit installation of fastenings.

7.15.2.4.2 Install the platform seals for the spacecraft area after completion of hinge fastening at elevation 91 feet, 2 inches (424-9230004).

7.15.2.5 Tension Strut and Handrail Installation

7.15.2.5.1 After fastening all hinges, attach the forward platform segment tension struts to the erector structure. This operation is performed with the erector in its "up" position, with platforms level.

(1) Weld the pivot bracket of the strut to the erector structure while the strut is fully open and carrying a portion of the platform load.

7.15.2.5.2 Install the handrail assemblies at the appropriate elevation.

NOTE: Remove and store the handrails (in the spacecraft area) on the fixed platform whenever the folding platforms are operated; fold down the original erector handrails during folding platform operation.

Note: Remove and store the handrails (in the spacecraft area) on the fixed platform whenever the folding platforms are operated; fold down the original erector handrails during folding platform operation.

7.15.3 Checkout

7.15.3.1 Functional Test

Platform checkout consists primarily of a functional and a platform load-carrying check. Initiation of the checkout procedures is accomplished only after visual inspection verifies that all field installation has been properly accomplished.

7.15.3.1.1 Check the operation of all folding platforms on the CVE and SSE while the erector is in a vertical position.

(1) Operate the hydraulic actuators using the checkout procedure established in GSTP 424-1039/AMR and GSTP 424-1040/AMR to verify the functional operating characteristics.

7.15.3.2 Proof Load Test

7.15.3.2.1 With the platform segments in their "down" positions, proof load the entire folding platform to simulate the live loads for which it is designed (i.e., 50 psf uniform loading or a 1000-pound load on a 2.5-square foot area). The entire folding platform at one elevation should be proof loaded at one time to simulate operational conditions.

7.15.4 Documentation

Complete Vehicle Erector Platform

Document No.	Title	Platform Elevation (feet)	Platform Elevation (inches)
804B9170131-009	Platform Installation		
804B9270026-009	Platform Assembly		
		9	8
804B9270027-009	Platform Assembly		
804B9270025-009	Platform Assembly		

Document No.	Title	Platform Elevation (feet)	(inches)
804B9170113-019 804C9170413-009	Platform Installation Platform Assembly	35	4-3/16
804C9170413-019	Platform Assembly	60	6
804C9170413-029	Platform Assembly	60 35	6 4-3/16
327-4770752-010	Platform Assembly	35	4-3/16
327-4770752-020	Platform Assembly	60	6
804C9170417-009 804C9170412-009	Platform Assembly Platform Assembly	35	4-3/16
804B9170114-019 804B9170119-009 804B9170132-009	Platform Installation Platform Assembly Platform Assembly	60	6
804C9170430-009 804B9170432-009 804B9170124-009 804B9170124-010 804B9170121-009 804B9170431-009	Platform Installation Platform Assembly Platform Assembly Platform Assembly Platform Assembly Platform Assembly	70	3
804C9170409-009 804C9170436-009 804C9170423-009 804C9170423-019 804C9170435-009 804C9170414-009	Platform Installation Platform Assembly Platform Assembly Platform Assembly Platform Assembly Platform Assembly	80	8
424-9230001 424-9230005L 424-9230005R 424-9230008 424-9230007 424-9230004	Platform Installation Platform Assembly Platform Assembly Platform Assembly Platform Assembly Platform Assembly	91	2
424-9230002 424-9230010L 424-9230010R 424-9230011 424-9230012	Platform Installation Platform Assembly Platform Assembly Platform Assembly Platform Assembly	100	2

Document No.	Title	Platform Elevation (feet) (inches)
424-9230003	Platform Installation	
424-9230006L	Platform Assembly	
424-9230006R	Platform Assembly	109 2
424-9230009L	Platform Assembly	
424-9230009R	Platform Assembly	
804B9170115-019	Platform Installation	
804B9170122-009	Platform Assembly	
804B9280107-009	Platform Assembly	20 5/16
804B9280107-010	Platform Assembly	
804B9170121-029	Platform Assembly	
804B9170123-019	Platform Assembly	
804B9180103-019	Platform Installation	
804B9180126-009	Platform Assembly	
804B9180127-019	Platform Assembly	30 5-5/16
804B9180127-029	Platform Assembly	
804B9180128-009	Platform Assembly	
804B9180129-009	Platform Assembly	
327-4770777-039	Platform Installation	
327-4770765-019	Platform Assembly	
327-4780054-019	Platform Assembly	
327-4780054-020	Platform Assembly	
327-4770768-009	Platform Assembly	
327-4770768-010	Platform Assembly	38 6-5/16
327-4770802-009	Platform Adapters	
327-4770802-039	Platform Adapters	
327-4770802-040	Platform Adapters	
327-4770791-009	Platform Adapters	
327-4770791-010	Platform Adapters	
424 1039/AMR	Ground System Test Procedure, Erector, Stage I	
424 1040/AMR	Ground System Test Procedure, Erector, Stage II	

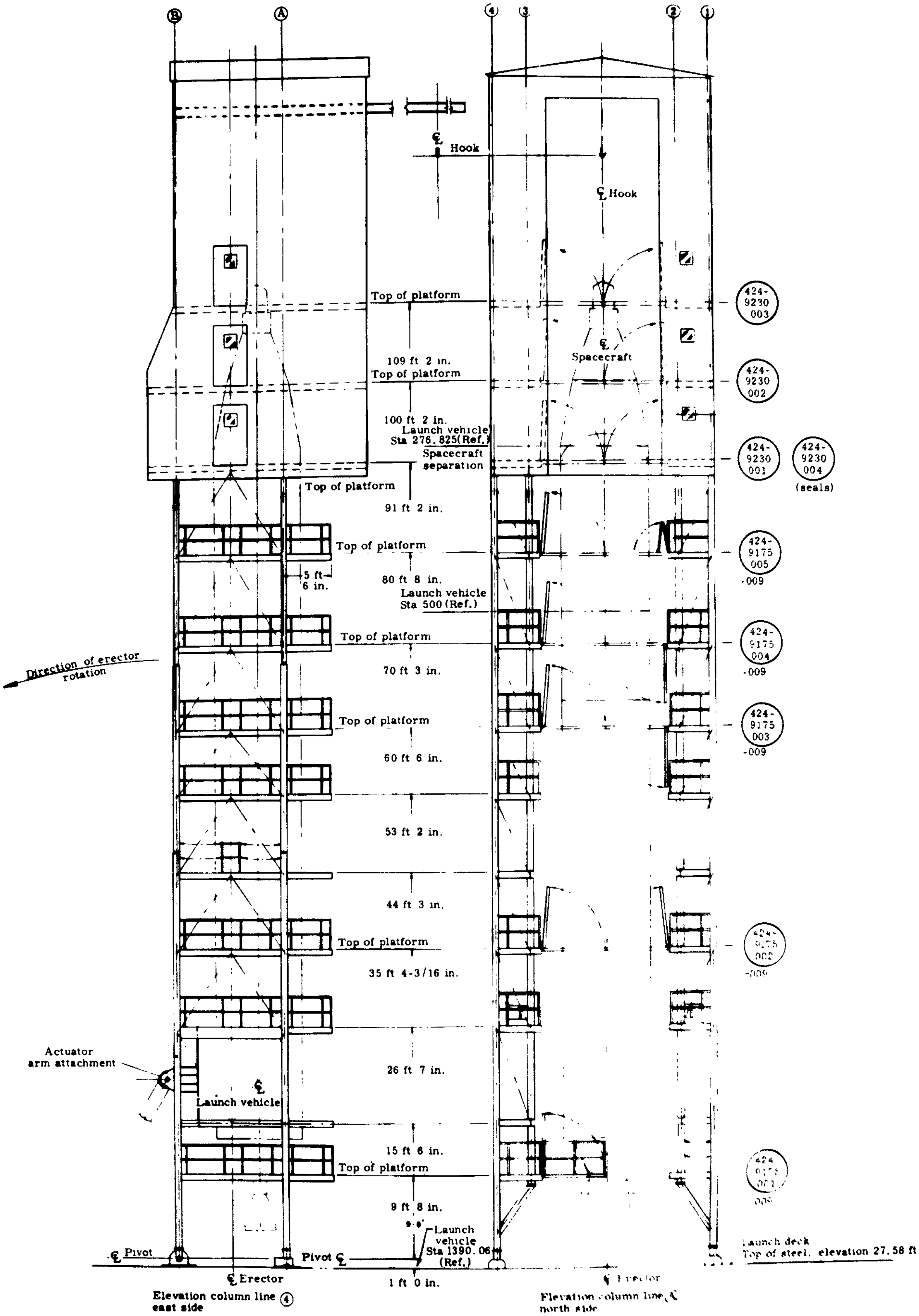
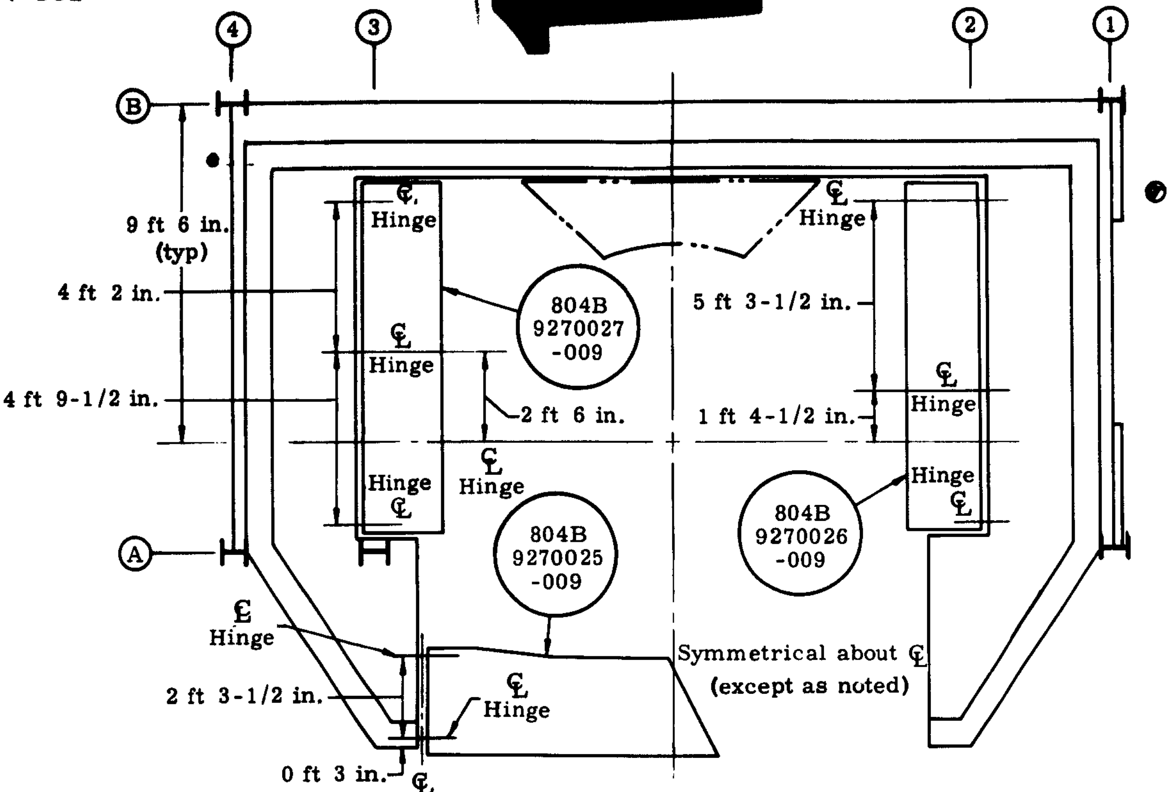
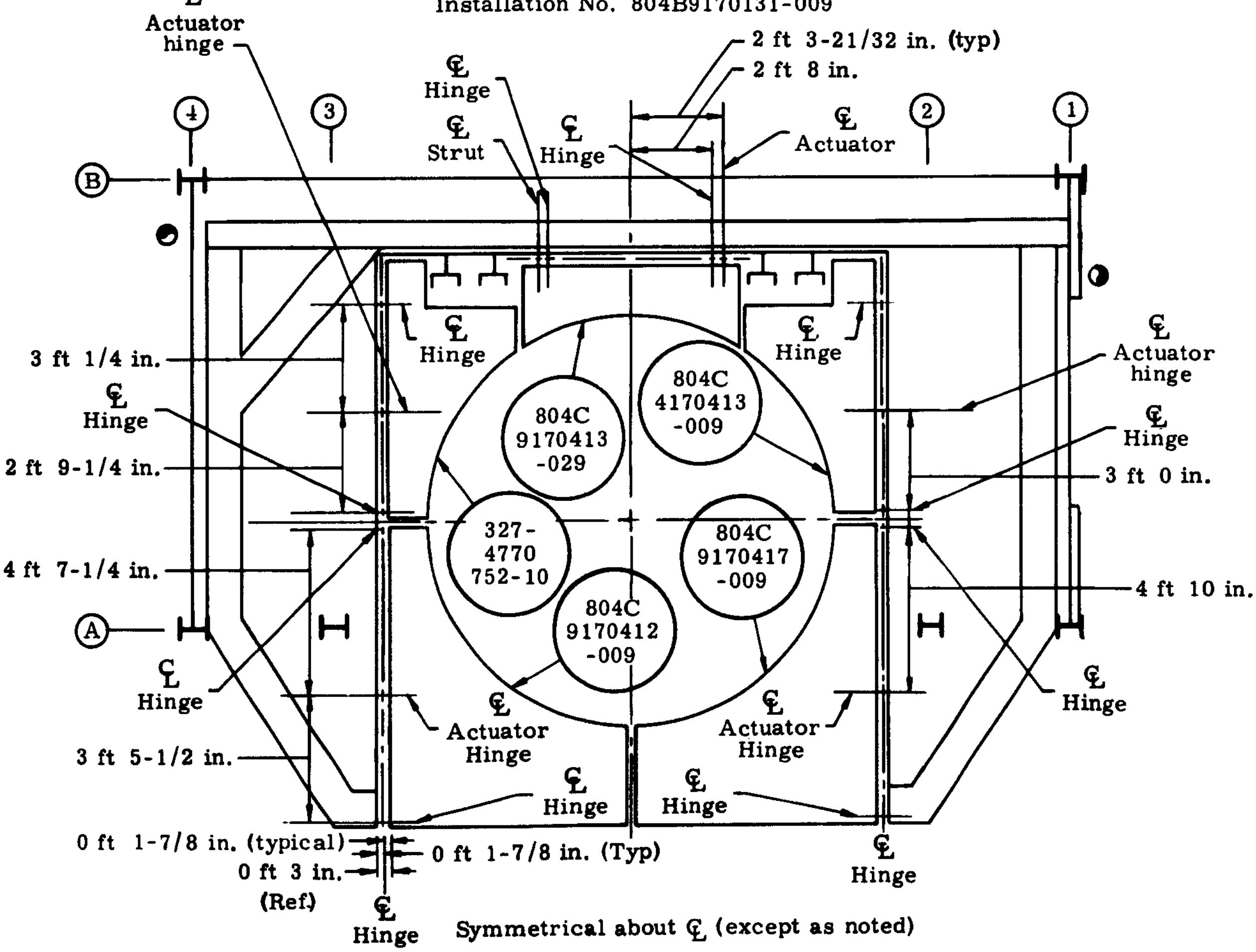


Fig. 7-55. Complete Vehicle Erector Work Platform Locations

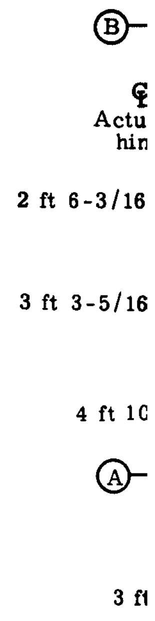
[redacted]

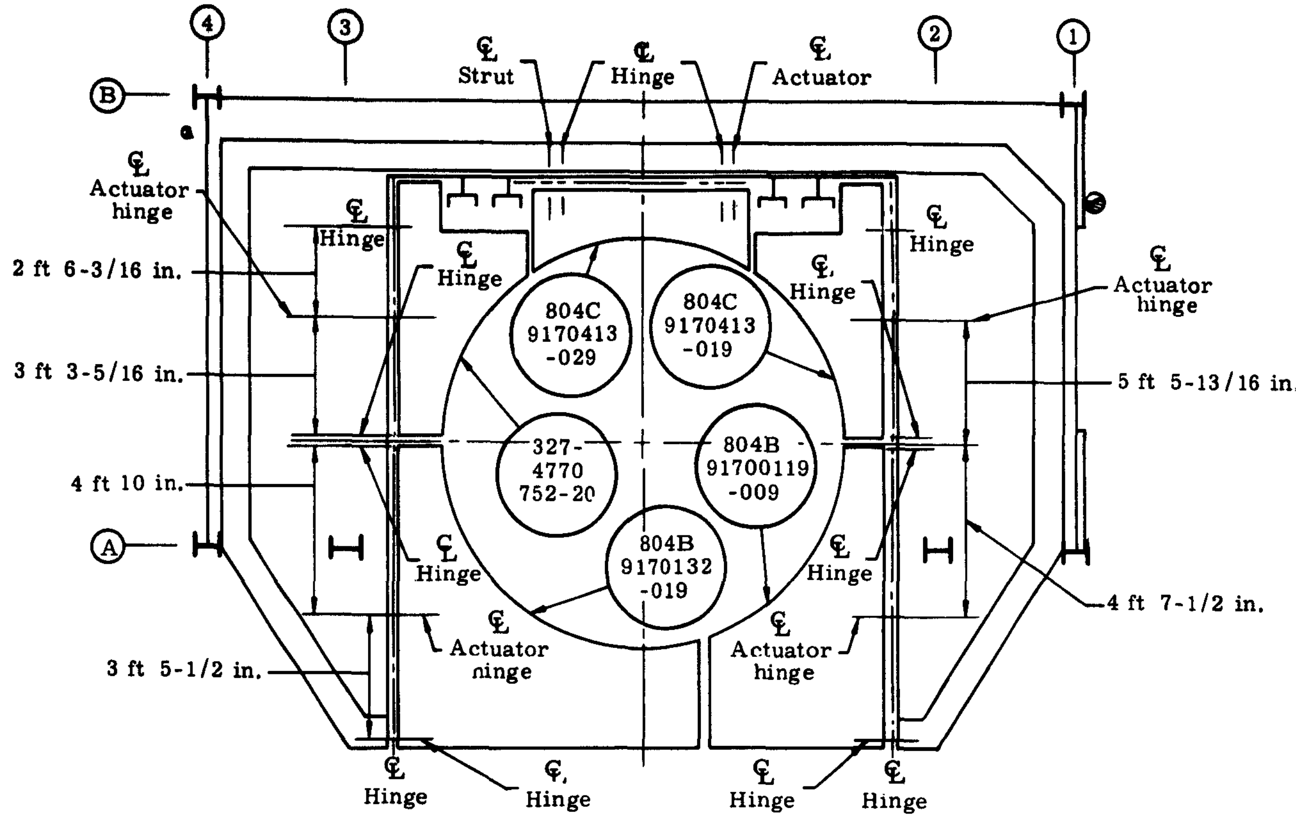


Platform at 9 ft 8 in.
Installation No. 804B9170131-009



Platform at 35 ft 4-3/16 in.
Installation No. 804B9170113-019





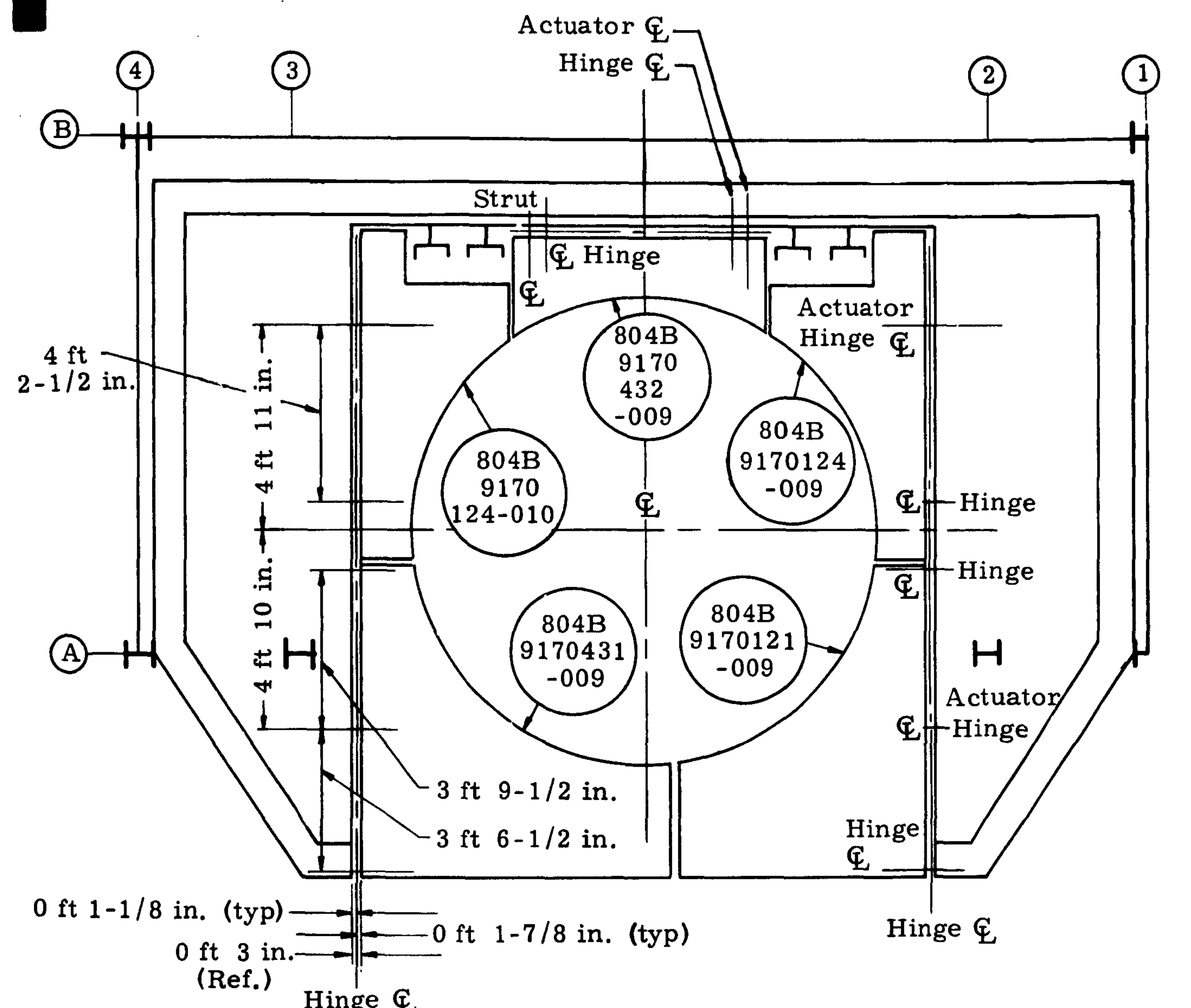
Symmetrical about ℄ (except as noted)

Platform at 60 ft 6 in.
Installation No. 804B9170114-019

2

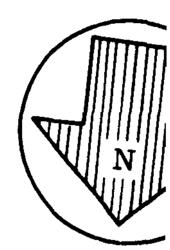
Fig. 7-56. Folding Platforms, Launch Vehicle Erector (9 ft 8 in.)

1

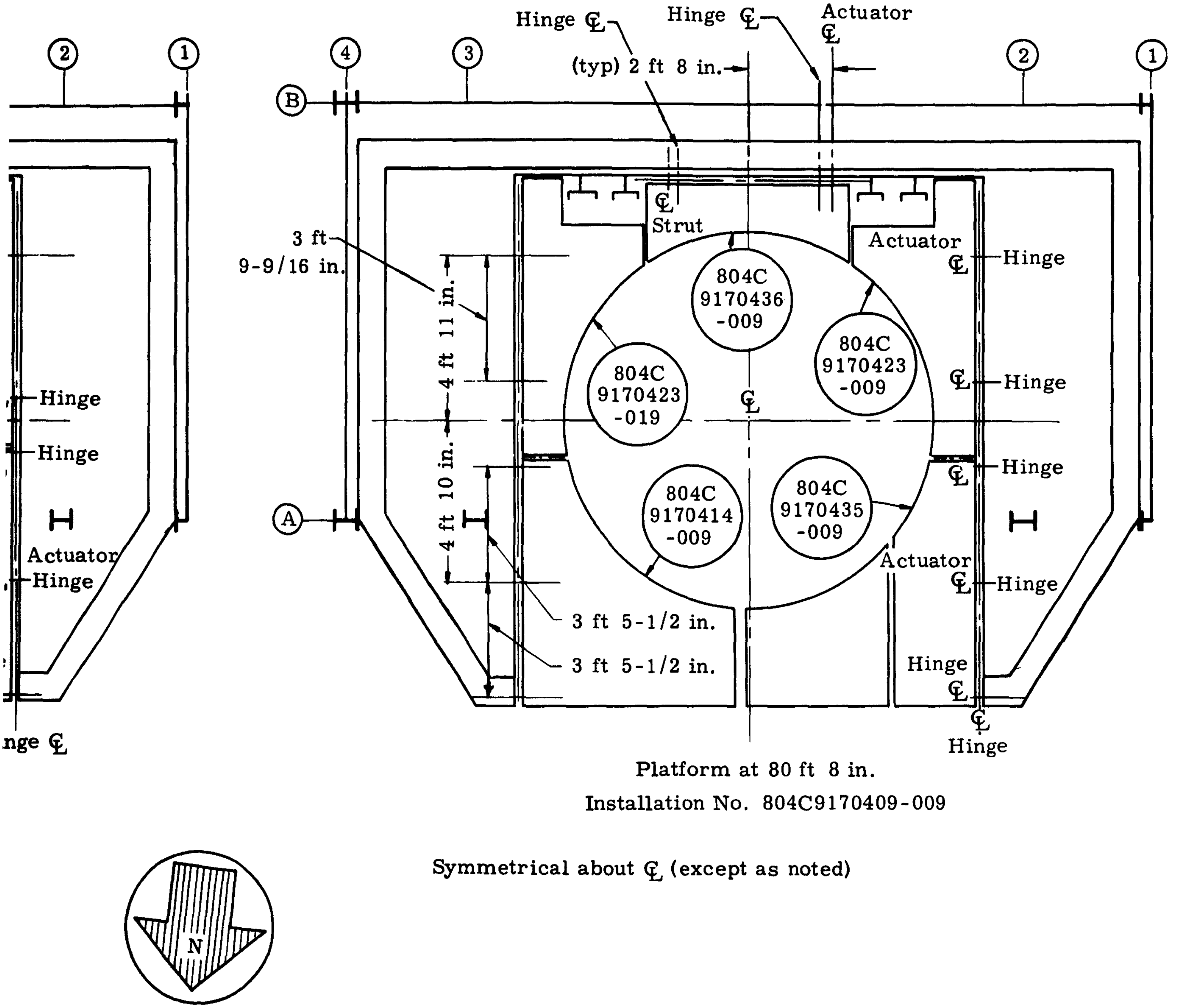


Platform at 70 ft 3 in.
Installation No. 804C9170430-009

Symmetrical about ℄ (except as noted)



2

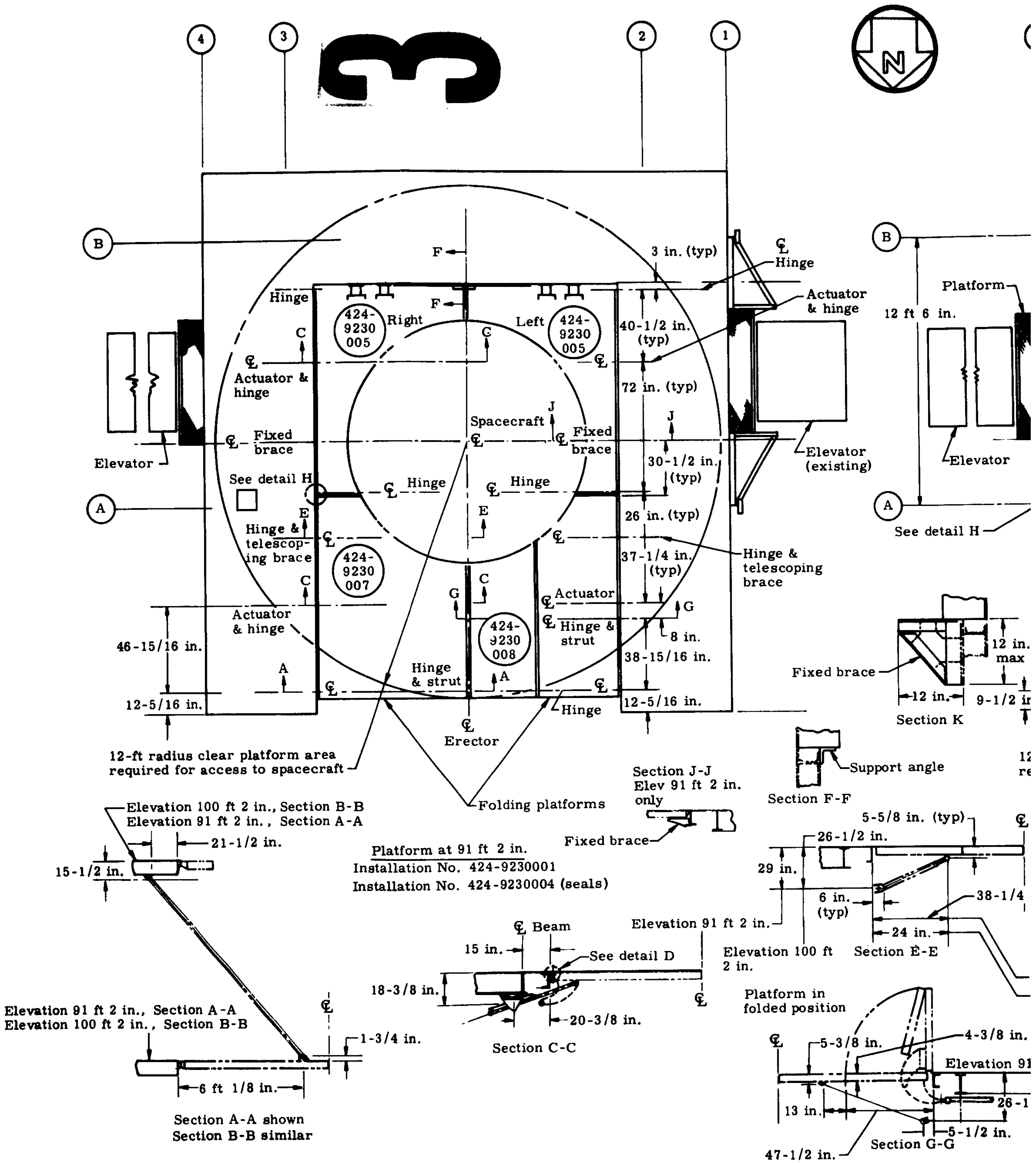


Platform at 80 ft 8 in.

Installation No. 804C9170409-009

Symmetrical about ℄ (except as noted)

Fig. 7-57. Folding Platforms, Launch Vehicle Erector (90 ft 3 in.)


3
N
4
3
2
1
B
A
3 in. (typ)
Hinge
Actuator & hinge
Hinge
424-9230 005
Right
Left
424-9230 005
40-1/2 in. (typ)
Actuator & hinge
72 in. (typ)
Spacecraft
Fixed brace
Fixed brace
Elevator
Elevator (existing)
30-1/2 in. (typ)
See detail H
Hinge
Hinge
26 in. (typ)
Hinge & telescoping brace
424-9230 007
37-1/4 in. (typ)
Hinge & telescoping brace
Actuator
Hinge & strut
424-9230 008
8 in.
Actuator & hinge
46-15/16 in.
38-15/16 in.
Hinge & strut
12-5/16 in.
12-5/16 in.
Hinge
Erector
12-ft radius clear platform area required for access to spacecraft
Folding platforms
12 ft 6 in.
Platform
Elevator
See detail H
12 in. max
Fixed brace
12 in.
9-1/2 in.
Section K
Support angle
Section F-F
Section J-J
Elev 91 ft 2 in. only
Fixed brace
Elevation 100 ft 2 in., Section B-B
Elevation 91 ft 2 in., Section A-A
21-1/2 in.
15-1/2 in.
Platform at 91 ft 2 in.
Installation No. 424-9230001
Installation No. 424-9230004 (seals)
Elevation 91 ft 2 in., Section A-A
Elevation 100 ft 2 in., Section B-B
1-3/4 in.
6 ft 1/8 in.
Section A-A shown
Section B-B similar
Beam
15 in.
See detail D
18-3/8 in.
20-3/8 in.
Section C-C
Elevation 91 ft 2 in.
5-5/8 in. (typ)
26-1/2 in.
29 in.
6 in. (typ)
38-1/4
24 in.
Elevation 100 ft 2 in.
Section E-E
Platform in folded position
5-3/8 in.
4-3/8 in.
Elevation 91
13 in.
5-1/2 in.
Section G-G
47-1/2 in.

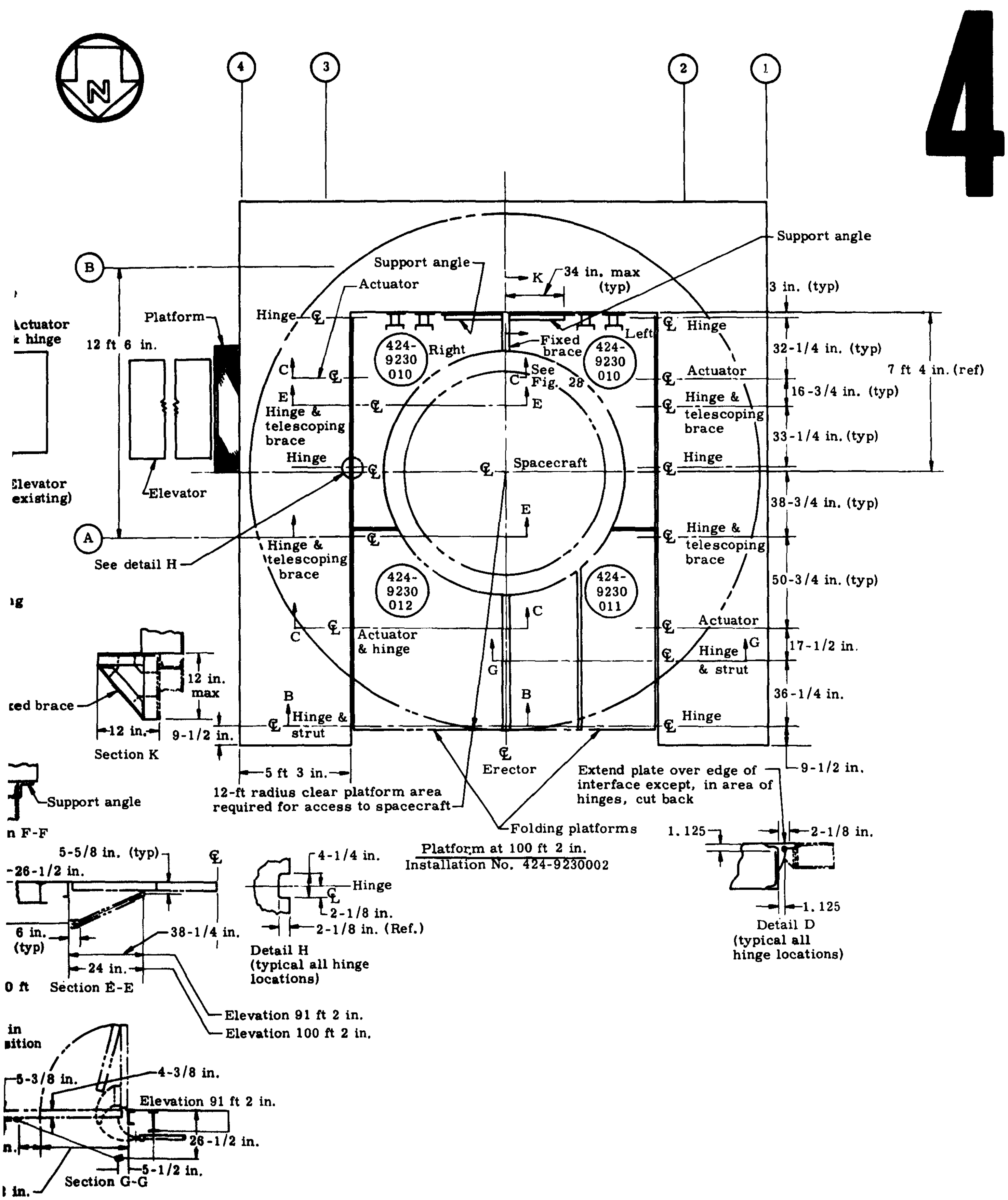
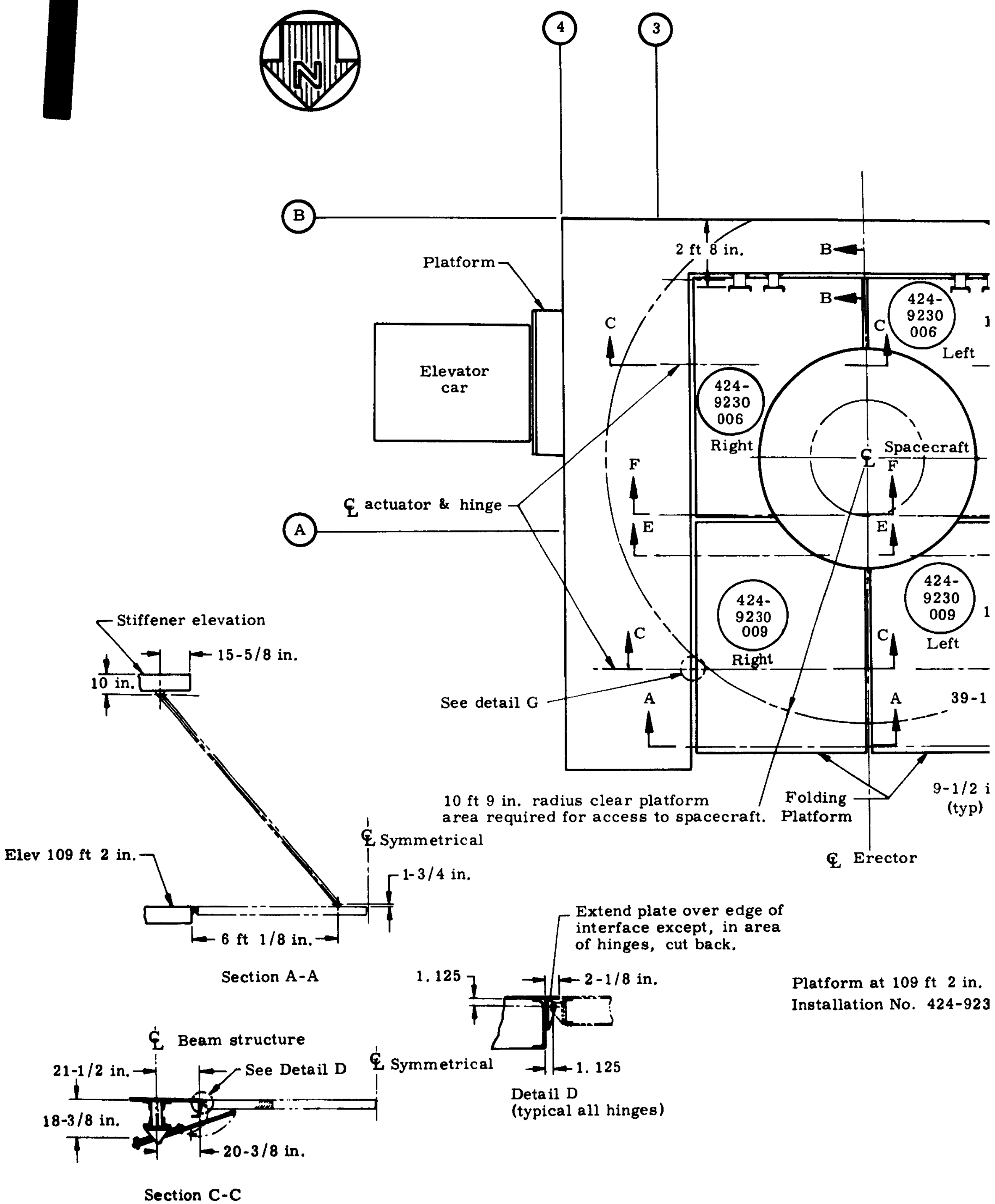
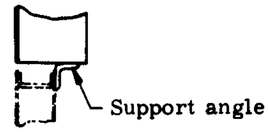


Fig. 7-58. Folding Platforms, Complete Vehicle Erector (91 ft 2 in. and 100 ft 2 in.)

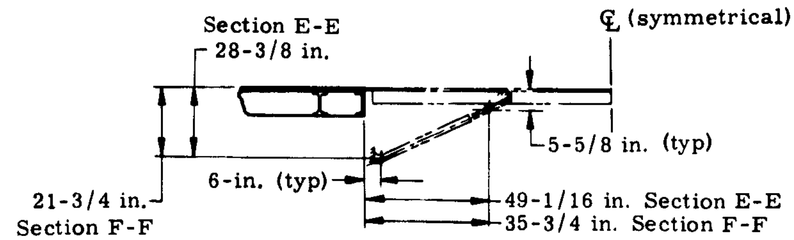
1



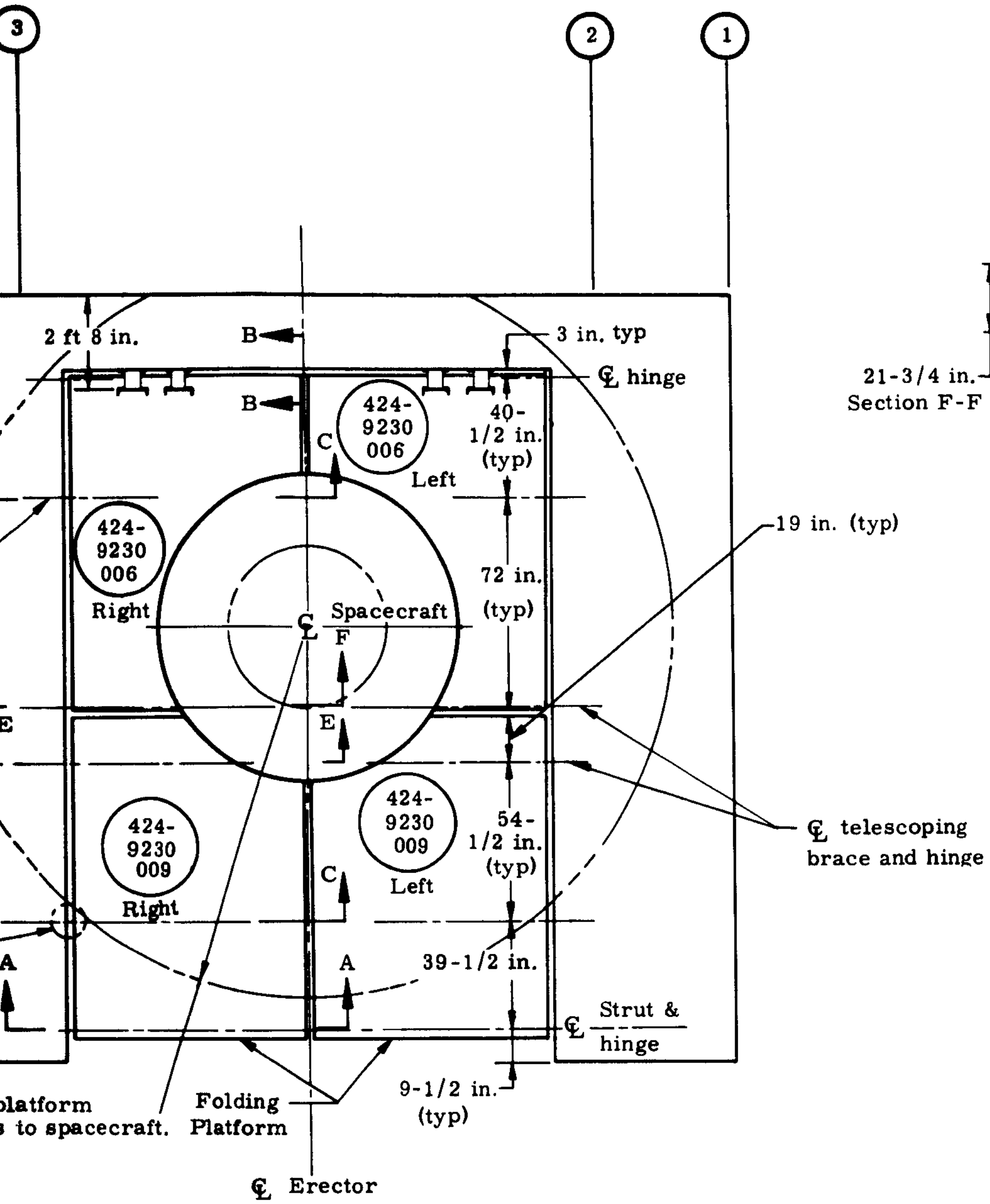
N
4
3
B
A
2 ft 8 in.
Platform
Elevator car
424-9230 006
Right
424-9230 006
Left
Spacecraft
424-9230 009
Right
424-9230 009
Left
℄ actuator & hinge
See detail G
10 ft 9 in. radius clear platform area required for access to spacecraft.
Folding Platform
9-1/2 i (typ)
℄ Erector
39-1
Platform at 109 ft 2 in.
Installation No. 424-923
Stiffener elevation
15-5/8 in.
10 in.
Elev 109 ft 2 in.
℄ Symmetrical
1-3/4 in.
6 ft 1/8 in.
Section A-A
Extend plate over edge of interface except, in area of hinges, cut back.
1.125
2-1/8 in.
1.125
Detail D (typical all hinges)
℄ Beam structure
21-1/2 in.
See Detail D
℄ Symmetrical
18-3/8 in.
20-3/8 in.
Section C-C



Section B-B



Section E-E shown
Section F-F similar

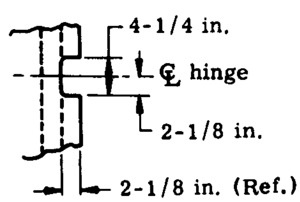


2

late over edge of
e except, in area
s, cut back.

n.

Platform at 109 ft 2 in.
Installation No. 424-9230003

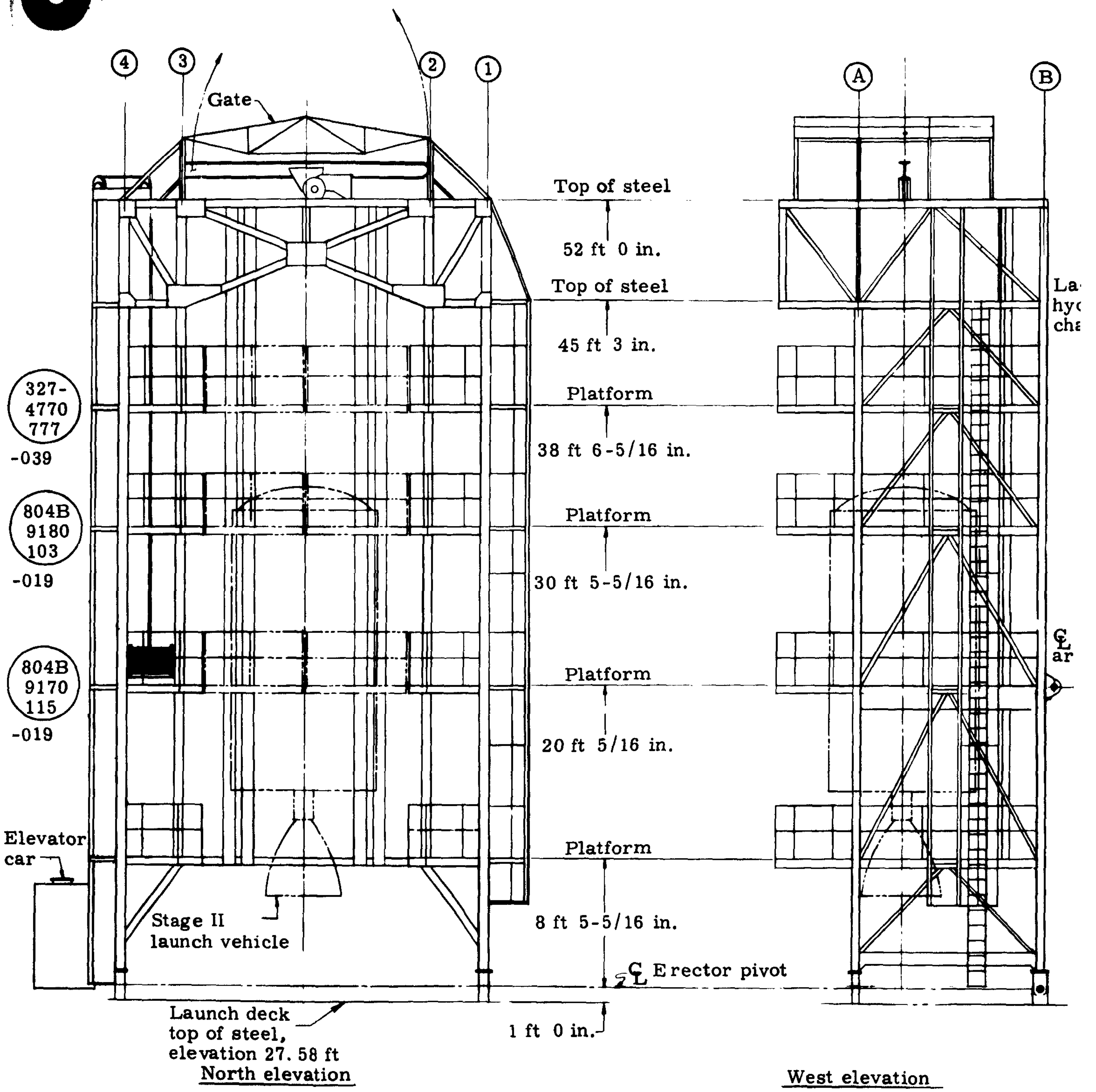


Detail G
(typical all
hinge locations)

es)

Fig. 7-59. Folding Platforms, Complete Vehicle Erector (109 ft-2 in.)

3


4
3
2
1
A
B
Gate
Top of steel
52 ft 0 in.
Top of steel
45 ft 3 in.
Platform
38 ft 6-5/16 in.
Platform
30 ft 5-5/16 in.
Platform
20 ft 5/16 in.
Platform
8 ft 5-5/16 in.
CL Erector pivot
1 ft 0 in.
327-4770777
-039
804B 9180 103
-019
804B 9170 115
-019
Elevator car
Stage II launch vehicle
Launch deck top of steel, elevation 27.58 ft
North elevation
West elevation

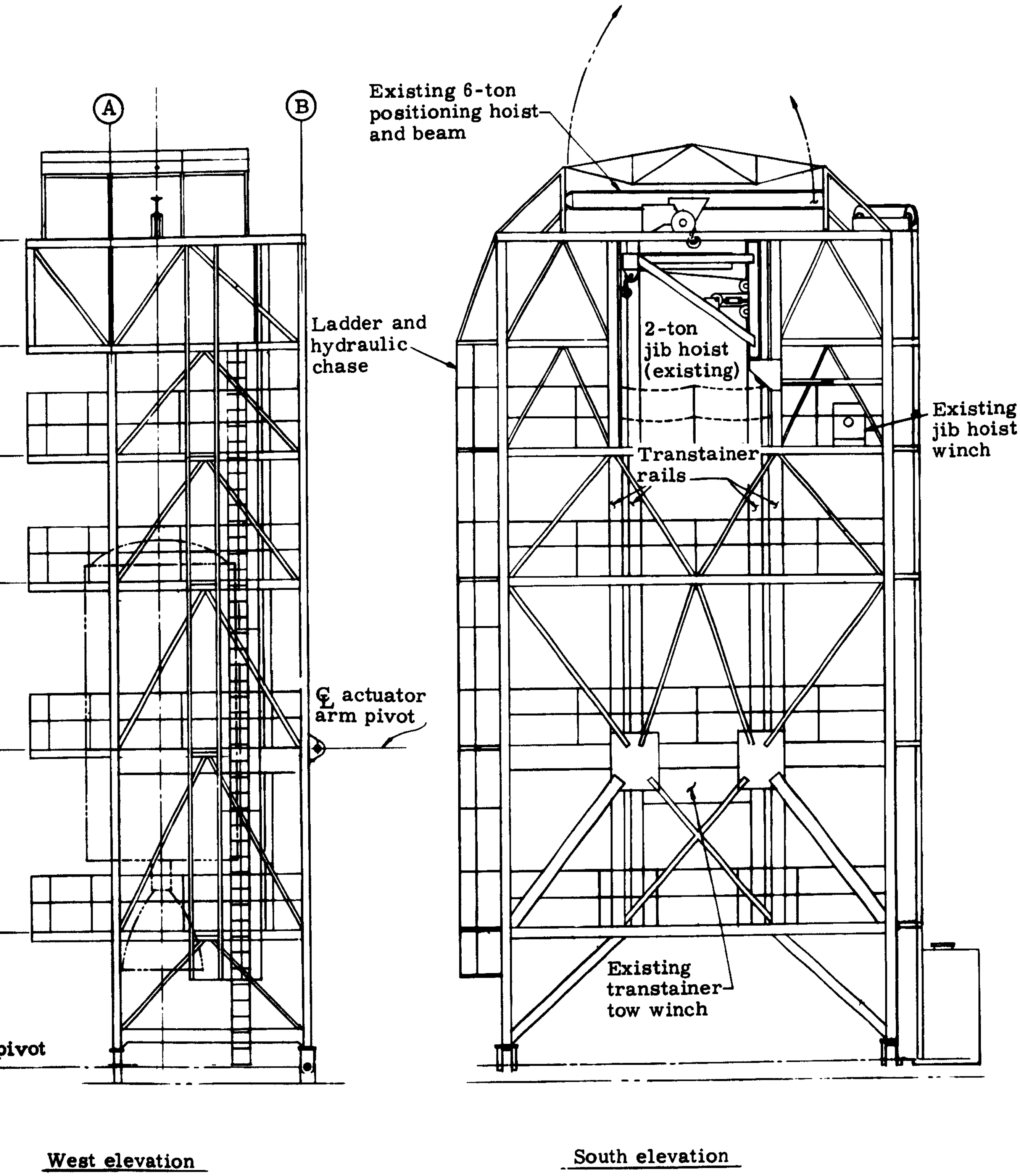
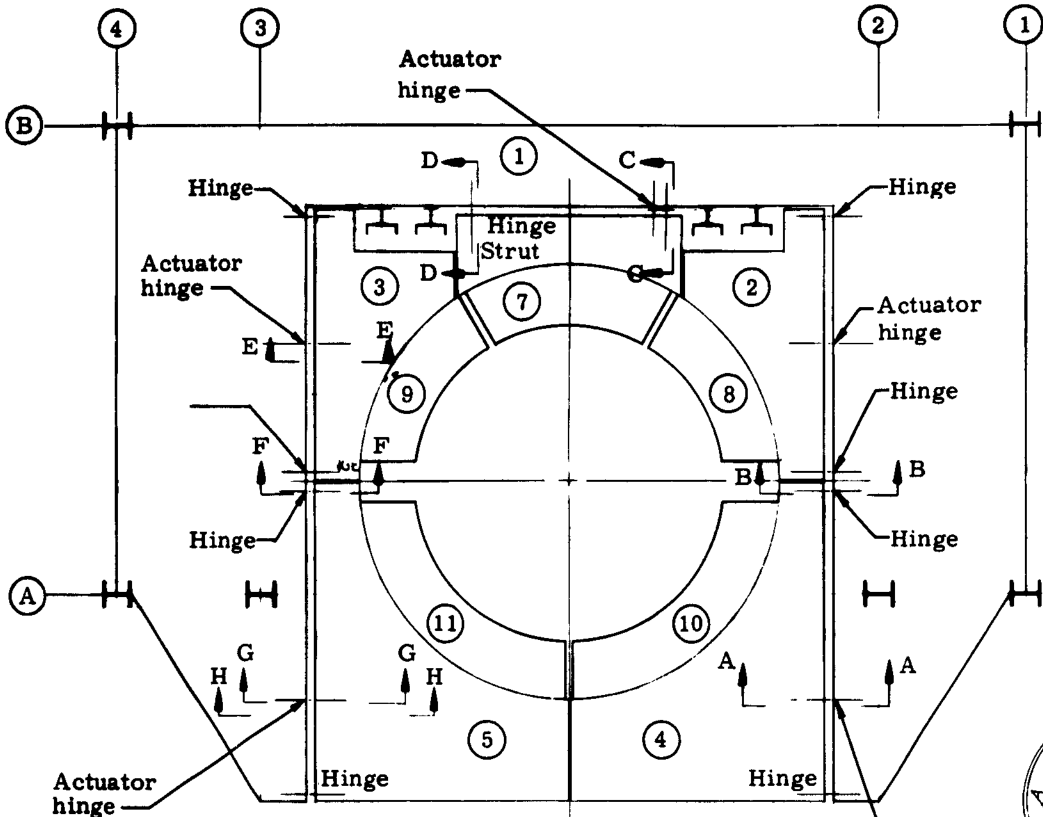
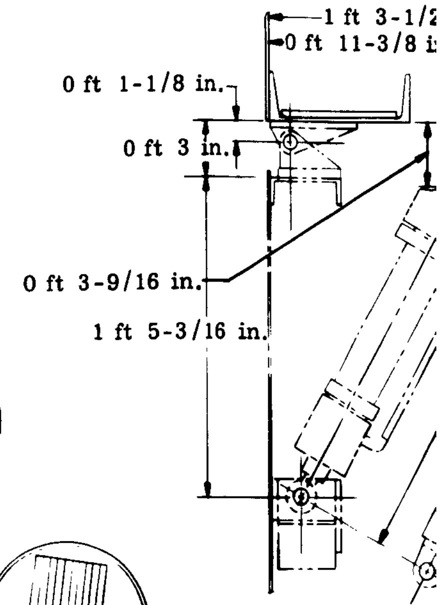


Fig. 7-60. Second Stage Erector Work Platform Elevations

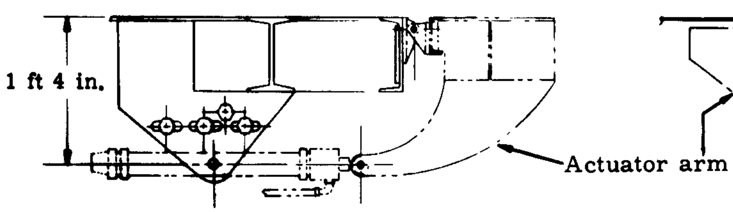
[redacted]



General arrangement
Complete vehicle &
second stage erector
platforms

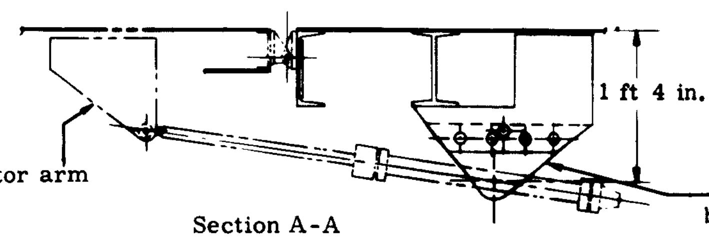


Section C-C
Section D-D
Typical for platforms
35 ft 4-3/16 in. } Co
60 ft 6 in. } veh
80 ft 8 in. } ere



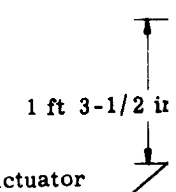
Section E-E
Typical for platforms at
60 ft 6 in. (3 places) } Complete
70 ft 3 in. (3 places) } vehicle
80 ft 8 in. (4 places) } erector

20 ft 5/16 in. (3 places) } Second
30 ft 5-5/16 in. (4 places) } stage
38 ft 6-5/16 in. (4 places) } erector

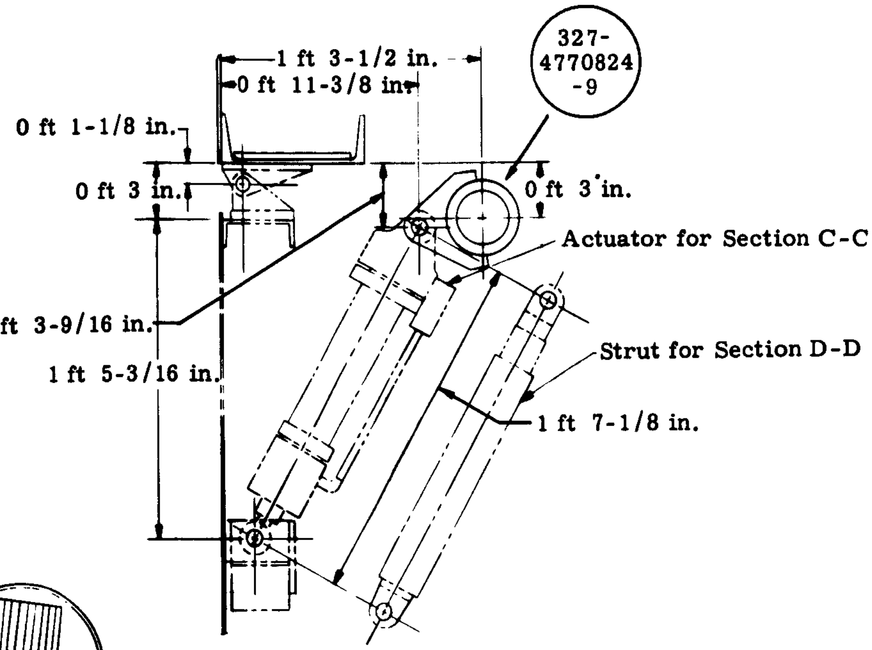


Section A-A
Typical for platforms at
60 ft 6 in. (1 place) } Complete vehicle
70 ft 6 in. (1 place) } erector

20 ft 5/16 in. (1 place)--Second Stage erector

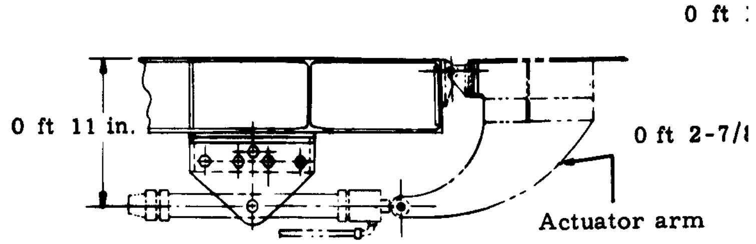


2



Section C-C
Section D-D
Typical for platforms at
35 ft 4-3/16 in. } Complete
60 ft 6 in. } vehicle
80 ft 8 in. } erector

20 ft. 5/16 in. } Second
30 ft. 5-5/16 in. } stage
38 ft 6-5/16 in. } erector

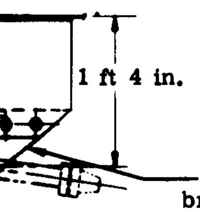


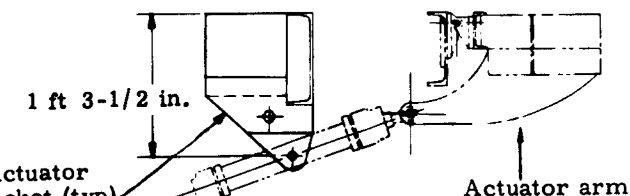
Section G-G
Typical for platform at
35 ft 4-3/16 in. (4 places)
--Complete vehicle erector

Typ
60 f
70 f

20 f
--S

Subassembly	
Elevation	20 ft
Install.	804B9
Plat. Assy No. 1	804B9
Plat. Assy No. 2	804B9
Plat. Assy No. 3	804B9
Plat. Assy No. 4	804B9
Plat. Assy No. 5	804B9
Adapters No. 7	
Adapters No. 8	
Adapters No. 9	
Adapters No. 10	
Adapters No. 11	



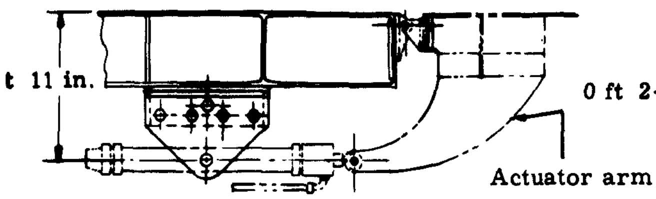


Actuator
bracket (typ)

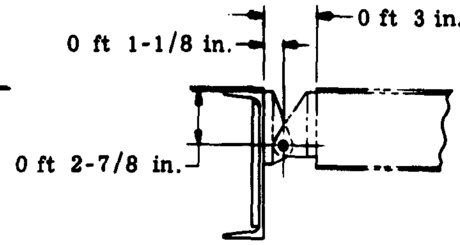
Section H-H
For platform at
9 ft. 8 in. --complete vehicle erector

te vehicle

nd Stage erector

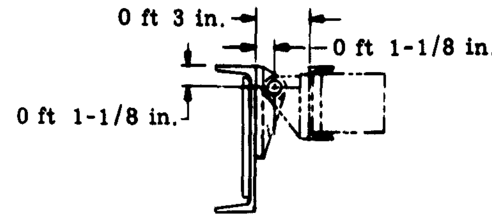


Section G-G
Typical for platform at
35 ft 4-3/16 in. (4 places)
--Complete vehicle erector



Section B-B
Typical for platforms at
60 ft 6 in. (2 places) } Complete vehicle
70 ft 3 in. (2 places) } erector

20 ft 5/16 in. (2 places)
--Second stage erector



Section F-F
Typical for platforms at
9 ft 8 in. (7 places) }
35 ft 4-3/16 in. (10 places) } Complete
60 ft 6 in. (8 places) } vehicle
70 ft 3 in. (7 places) } erector
80 ft 8 in. (8 places)

20 ft 5/16 in. (6 places) } Second
30 ft 5-5/16 in. (10 places) } stage
38 ft 6-5/16 in. (10 places) } erector

Subassembly & Installation Drawings Nos. (Stage II Erector)			
Elevation	20 ft 5/16 in.	30 ft 5-5/16 in.	38 ft 6-5/16 in.
Install.	804B9170115-019	804B9180103-019	327-4770777-039
Plat. Assy No. 1	804B9170122-009	804B9180126-009	327-4770765-019
Plat. Assy No. 2	804B9280107-009	804B9180127-019	327-4780054- 19
Plat. Assy No. 3	804B9280107-010	804B9180127-020	327-4780054- 20
Plat. Assy No. 4	804B9170121-029	804B9180128-009	327-4770768- 9
Plat. Assy No. 5	804B9170123-019	804B9180129-009	327-4770768- 10
Adapters No. 7			327-4770802- 9
Adapters No. 8			327-4770802- 39
Adapters No. 9			327-4770802- 40
Adapters No. 10			327-4770791- 9
Adapters No. 11			327-4770791- 10

Fig. 7-61. Stage II Erector Work Platform Details

7.16 PROPELLANT SYSTEM CONTROL SET INSTALLATION (CP2500)

7.16.1 Description

The Propellant System Control Set (PSCS) provides the following control and/or monitor capabilities to the blockhouse:

(1) Starts and stops the transfer of propellants during both fill and drain operations between the launch vehicle and the ready storage vessel. Provisions for dual loading and unloading are incorporated.

(2) Displays the quantity of propellant transferred between ready storage vessels and launch vehicle tanks. Measurements shall be made by using flowmeters in the distribution unit.

(3) Activates pressurization of the launch vehicle tanks and transfer lines for blanket or flight readiness conditions.

(4) Activates venting of the launch vehicle tanks and adjoining lines.

(5) Monitors the pressure parameters selected for hold or kill functions during captive firing tests or launch operations.

(6) Controls and displays the position of selected pressurization and liquid delivery valves and monitors and controls the mode of operation of the facility vapor disposal units.

(7) Monitors launch vehicle tank pressures and liquid level sensors.

(8) Monitors the summation circuit in the Propellant Transfer and Pressurization System (PTPS) to verify the position of critical manually operated valves.

(9) Controls and displays the position of the Stage I engine fuel bleed valve if a hold is necessary after prevalve actuation.

In addition, the PSCS controls purging of the PTPS transfer lines and the launch vehicle tanks prior to the introduction of propellants. The PSCS also controls the purging of the launch vehicle tanks and the PTPS transfer lines after draining the launch vehicle tanks.

The PSCS consists of the following units:

(1) Propellant system control console (CP 2021), Locations 212 and 213.

(2) Propellant system control monitor rack (CP 2041), Location 110.

(3) PSCS cabling and interconnections.

(4) Local control panel, fuel holding area (CP 1560).

(5) Local control panel, oxidizer holding area (CP 1560).

7.16.2 Sequence of Events

7.16.2.1 Propellant System Control Console Installation

7.16.2.1.1 Install the propellant system control console (424-2021000) on the second floor of the blockhouse. The console shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.16.2.2 Propellant System Control Monitor Rack Installation

7.16.2.2.1 Install the propellant system control monitor rack (424-2041000) in the transfer room of the approach ramp building. The rack shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.16.2.3 Installation of PTPS Box Assembly, Fuel and Oxidizer Local Control Panel on Motor Control Center F

7.16.2.3.1 Install the PTPS box assembly, fuel and oxidizer local control panel (424-1560000) on Motor Control Center F located in the fuel holding area shelter. The panel shall be located and installed in accordance with Drawing 424-9550000, Propellant Transfer System Installation.

7.16.2.4 Installation of PTPS Box Assembly, Fuel and Oxidizer Local Control Panel on Motor Control Center O

7.16.2.4.1 Install the PTPS box assembly, fuel and oxidizer local control panel (424-1560000) on Motor Control Center O located in the oxidizer holding area shelter.

The panel shall be located and installed in accordance with Drawing 424-9550000, Propellant Transfer System Installation.

7.16.2.5 Cabling Installation

7.16.2.5.1 Install and connect cabling for the PSCS in accordance with Drawings 424-9501111, Cabling and Interconnection, PSCS, and 424-9503000, Cable Set Installation, AGE. Cables are installed as shown in Fig. 7-62.

7.16.3 Checkout Procedure

The cables must be installed and checked out in accordance with 424-9501001, AMR Cabling Test Specification, prior to conducting any functional test.

Checkout for verification of proper operation of the PSCS is included in GSTP 424-1033/AMR, Propellant Transfer and Pressurization System. The requirement to perform this test is established in the PTPS installation plan, Section 7.2. The PSCS will then be checked out concurrently with the PTPS test.

7.16.4 Documentation

Document No.	Title
424-2050300	Cable Set Installation, AGE
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2251000	AGE Installations, Blockhouse, Second Floor, Complex 19
424-9550000	Propellant Transfer System Installation
424-1560000	PTPS Box Assembly, Fuel and Oxidizer Local Control Panel
424-2021000	Propellant System Control Console
424-2041000	Propellant System Control Monitor Rack

Document No.	Title
424-9501001	AMR Cabling, Test Specification
424-9501111	PSCS Cabling and Interconnection
424-1033/AMR	GSTP, Propellant Transfer and Pressurization System

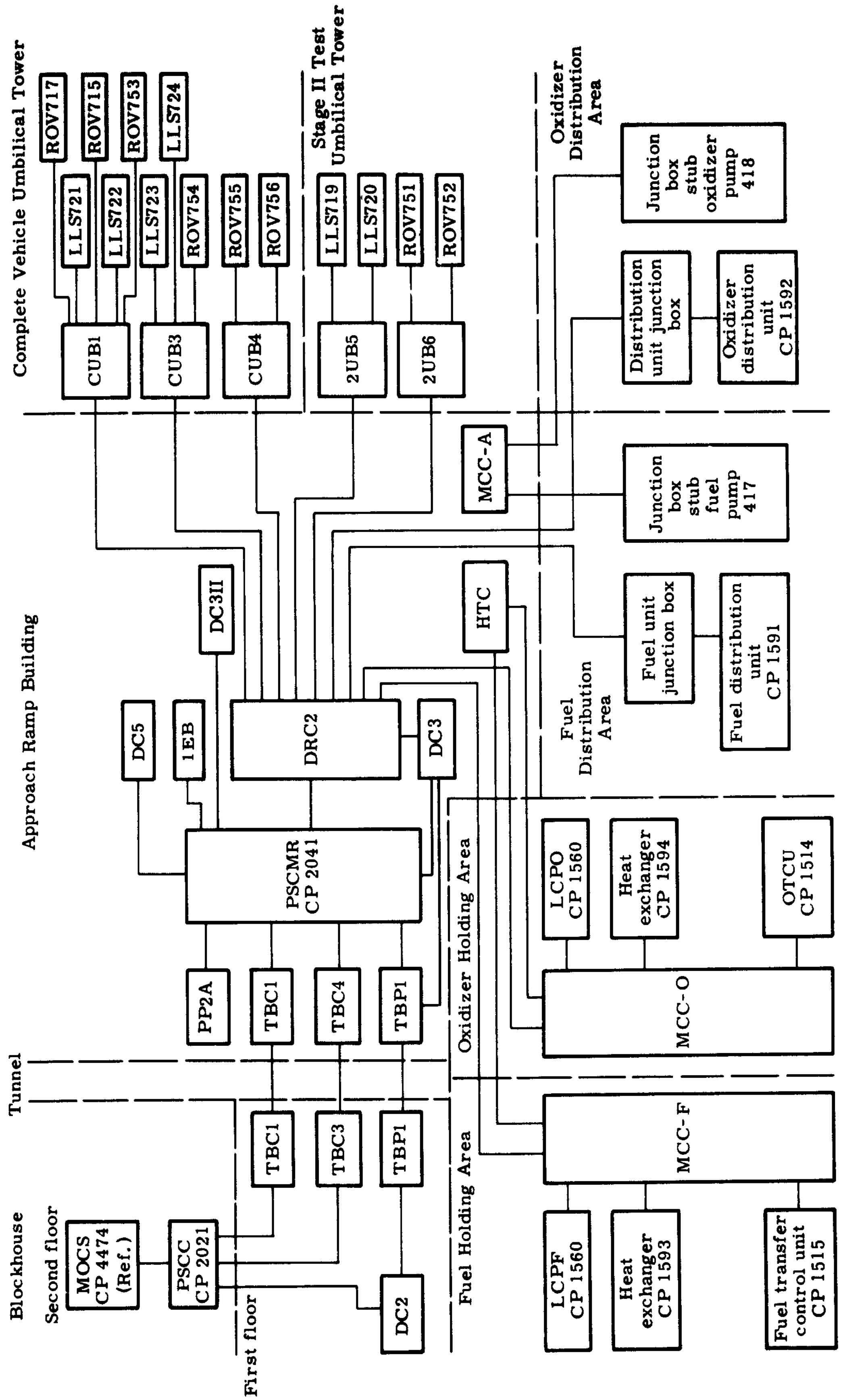


Fig. 7-62. Propellant System Control Set (cabling)

7.17 MASTER OPERATION CONTROL SYSTEM INSTALLATION

7.17.1 Description

The Master Operation Control System (MOCS) is used by the Test Conductor for observing and appraising the status of the launch vehicle and spacecraft during subsystem functional verification, combined system test, sequenced compatibility firing, flight readiness firing, and the final countdown and launch. Primarily, the MOCS provides functional control signals for the launch vehicle AGE and hold-fire interrogate signals to the launch vehicle and spacecraft AGE, monitors hold-fire signals from the launch vehicle and the spacecraft AGE, and provides communications between the test conductor and appropriate launch control personnel.

The MOCS consists of the following units:

			Location
(1)	Test conductor's console	(CP 4471)	243, 244, 245
(2)	Remote shutdown enclosures	(CP 4482)	240, 241, 242
(3)	Events control rack	(CP 4474)	20
(4)	Control system water and erector console	(CP 4472)	211, 246
(5)	Master sequencer, MILGO Model III		2, 3, 4, 5
(6)	Countdown readout unit		233-239, 250-253
(7)	Water umbilical and erector control rack	(CP 4473)	
(8)	MOCS interconnecting cables		217

7.17.2 Sequence of Events

7.17.2.1 Test Conductor's Console Installation

7.17.2.1.1 Install the Test Conductor's console (CP 4471) on the second floor of the blockhouse. This unit shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.17.2.2 Control System Water and Erector Console Installation

7.17.2.2.1 Install the control system water and erector console (CP 4472) on the second floor of the blockhouse. This unit shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.17.2.3 Events Control Rack Installation

7.17.2.3.1 Install the events control rack (CP 4474) on the first floor of the blockhouse. This unit shall be located and installed in accordance with Drawing 424-2151000, AGE Installation, Blockhouse, First Floor, Complex 19.

7.17.2.4 Remote Shutdown Switch Enclosures Utilization

7.17.2.4.1 Utilize, as presently installed, the remote shutdown switch enclosures (CP 4482) on the second floor of the blockhouse. The three units are installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse, Second Floor, Complex 19.

7.17.2.5 Countdown Readout Units Installation

7.17.2.5.1 Install the countdown readout units (PD327-00010-19) on the first and second floors of the blockhouse, the transfer room, the launch deck area, the fuel holding area, and the oxidizer holding area. The 20 units shall be installed in accordance with the following drawings:

Document No.	Title
424-2151000	AGE Installation, Blockhouse, First Floor, Complex 19
424-2251000	AGE Installation, Blockhouse, Second Floor, Complex 19
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2052000	AGE Installations, Approach Ramp and Launch Deck, Complete.

The unit is approximately 18 inches wide, 4 inches deep and 8 inches high. The units are mounted on the racks and consoles or in the following areas:

Blockhouse Second Floor

Area	Designation in Fig. 7-63
(1) Voltage controlled oscillator rack	RDT2
(2) Visitors' gallery	RDT1
(3) PDC rack	RDT14
(4) Test Conductor's console	RDT12
(5) Pad safety console	RDT11
(6) Recorder rack	RDT9
(7) Spacecraft aero-medical rack	RDT15
(8) Spacecraft guidance rack	RDT8
(9) Spacecraft Test Conductor's console	RDT7
(10) BLH rack	RDT6
(11) Instrumentation console	RDT5

Blockhouse First Floor

(12) Test Conductor operator room	RDT13
(13) Spacecraft command rack	RDT4

Test Deck Area

(14) Thrust ring area	RDT20

	Area	Designation in Fig. 7-63
(15)	Fuel holding area	RDT21
(16)	Oxidizer holding area	RDT22
	Approach Ramp Transfer Room	
(17)	Ramp area west side	RDT16
(18)	Spacecraft rack	RDT17
(19)	AGE rack	RDT18
(20)	ISE rack	RDT19

Units RDT3 and RDT10 are integral components of A30A and the time display board.

7.17.2.6 Master Sequencer MILGO Model III Utilization

7.17.2.6.1 Utilize the master sequencer MILGO Model III, as presently installed on the first floor of the blockhouse. The four racks are located in accordance with Drawing 424-2151000, AGE Installation, Blockhouse, First Floor, Complex 19.

7.17.2.7 Water Umbilical and Erector Control Rack Installation

7.17.2.7.1 Install the water erector and umbilical control rack (CP 4473) in the transfer room (first floor of the approach ramp building). The unit shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room. The rack contains the Process Water Control System (CP 2552).

7.17.2.8 MOCS Cables Installation

7.17.2.8.1 Install the cables (Fig. 7-63) for the MOCS in accordance with Drawings 424-9501121, Block Cordage; 424-9501002, AMR Cable Installation Requirements, Master Operation Control System and 424-2050300, Cable Set Installation, AGE.

Cables shall be installed in existing tunnel cable trays and blockhouse and transfer room cable areas. Cables shall be installed to connect the equipment shown in Fig. 7-63.

The cables must be checked out in accordance with AMR Cable Test Specification 424-9501001 prior to conducting functional tests.

7.17.3 Checkout Procedure

Conduct tests on the MOCS in accordance with Ground System Test Procedure 424-1031/AMR.

7.17.3.1 Test Objectives

7.17.3.1.1 Verify proper connections of functional control and hold-fire circuits to the AGE, and verify that all hold signals to the MOCS will initiate a hold sequence.

7.17.3.1.2 Verify that "hold" signals to the MOCS initiate a shutdown of sequencing and prevent Stage I engine firing and that "kill" signals to the MOCS initiate a shutdown of sequencing and discontinue engine firing.

7.17.3.1.3 Verify proper operation of the MOCS and operational AGE sequence interlocks.

7.17.4 Documentation

Document No.	Title
424-2251000	AGE Installation, Blockhouse, Second Floor, Complex 19
424-4471000	Test Conductor's Console
424-4472000	Control System Water Erector Console
424-4474000	Events Control Rack
424-2151000	AGE Installation, Blockhouse, First Floor, Complex 19
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room

Document No.	Title
424-2052000	AGE Installation Approach Ramp and Launch Deck Complete
PD 32700010	Countdown Readout Units
424-2050300	Cable Set Installation, AGE
424-9501002	AMR Cable Installation Requirements
424-9501121	Block Cordage, Master Operations Control System
424-9501001	AMR Cable Test Specification
424-1031/AMR	Ground System Test Requirements

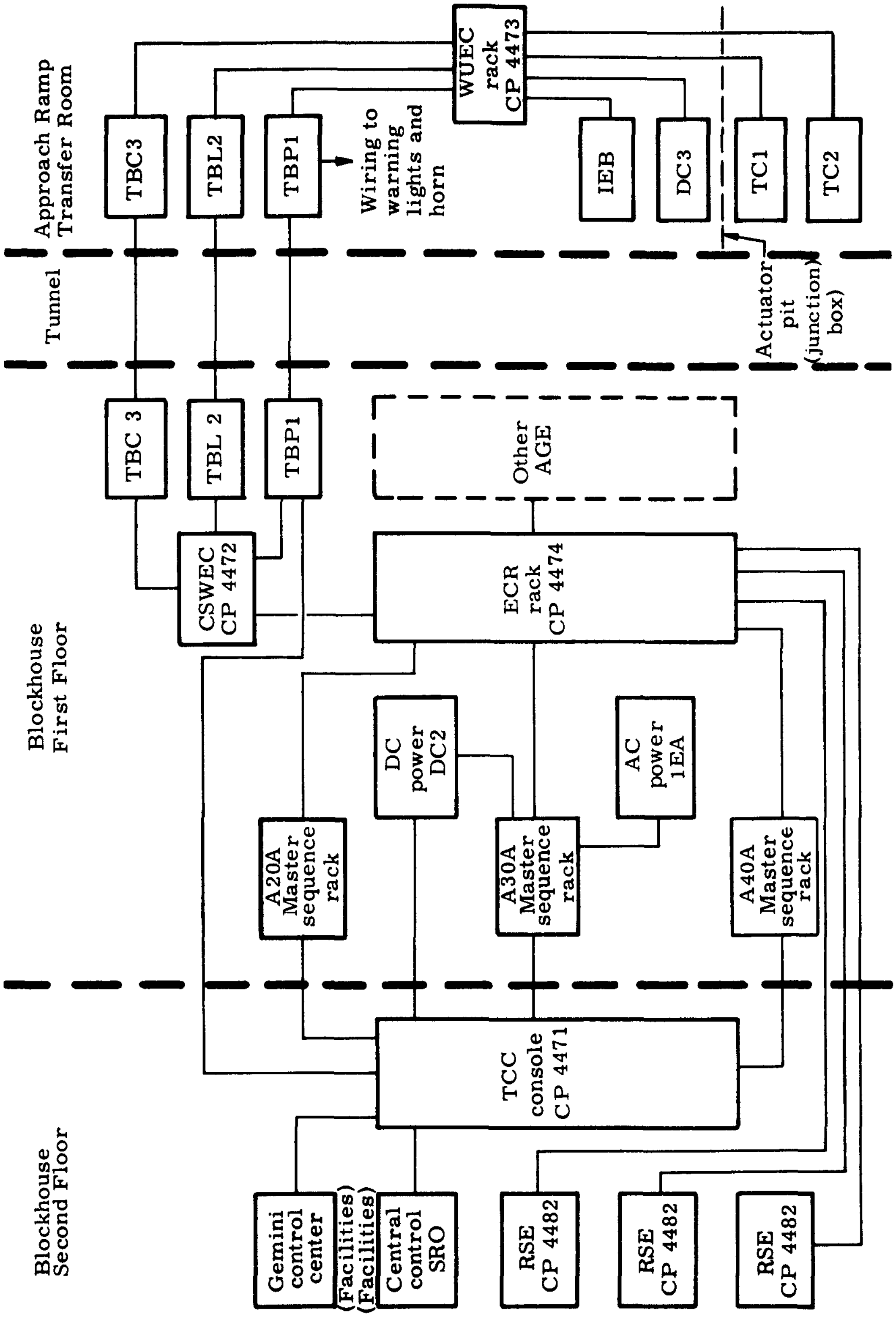


Fig. 7-63. Master Operations Control System Cabling

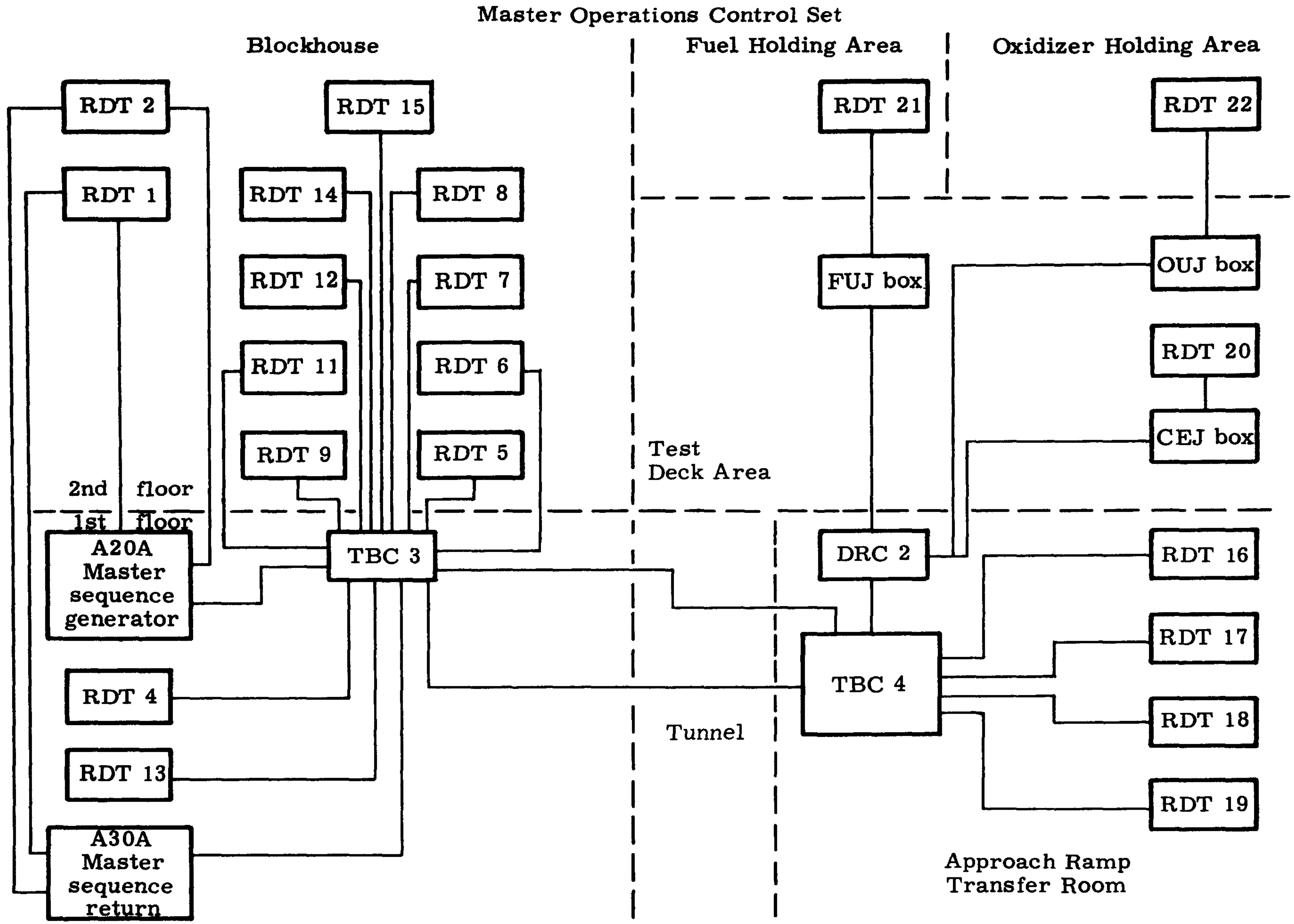
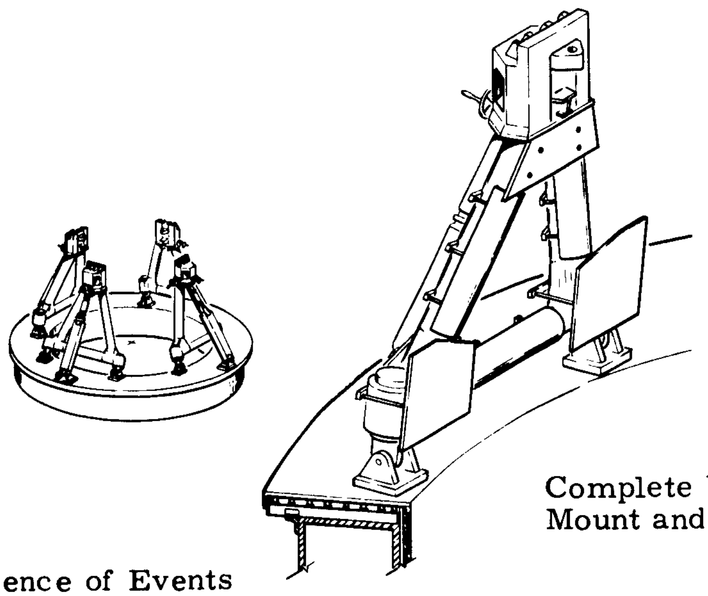


Fig. 7-63. Master Operations Control System Cabling (continued)

7.18 STAGE I THRUST MOUNT INSTALLATION

7.18.1 Description

The Stage I thrust mount is used to support the first stage of the launch vehicle and the complete air vehicle during sequential compatibility firing and to support the complete air vehicle during launch. The device must be capable of restraining Stage I during maximum thrust and wind loads. All components in the structure must be capable of withstanding the heat from the engine flame and the effects of fuel spillage.



Complete Vehicle Thrust Mount and Flame Shields

7.18.2 Sequence of Events

7.18.2.1 Existing Equipment Utilization

7.18.2.1.1 Utilize the existing load distribution ring (BLH Drawing E-503), four vertical load struts (424-9272210), flame shields around the vertical load struts (BLH Drawing E-521), three horizontal load struts (424-9272210) with their mounting brackets (BLH Drawings E-517 and E-518), and four tiedown brackets (BLH Drawing E-519) without modification.

7.18.2.2 Linkage Clevis Installation

7.18.2.2.1 Install four linkage clevises (424-9272204) on the top surface of the load distribution ring. Clevises are attached by bolts inserted into the existing tapped holes.

7.18.2.3 Foot Clevis Installation

7.18.2.3.1 Install eight foot clevises (424-9272302) on the top surface of the load distribution ring. Clevises are attached by bolts inserted into the existing tapped holes.

7.18.2.4 A-Frame Installation

7.18.2.4.1 Install four A-frames of the attachment frame assemblies (424-9272200) onto the load distribution ring.

The flat tops of the apex weldment of the A-frames have been modified according to Drawing 424-9272206.

Attach A-frames to the foot clevises with previously used clevis pins (424-9272204).

7.18.2.5 Box Strut and Turnbuckle Assembly Installation

7.18.2.5.1 Install four box struts (424-9272202) and four turnbuckle assemblies (424-9272202) onto the load distribution ring.

The box struts have been modified according to 424-9272200 (sheet 3).

7.18.2.6 Installation of Bolts to Plug Holes

7.18.2.6.1 Install bolts to plug holes in top surface of load distribution ring. Holes are due to removal of the hydraulic actuating cylinders for the attachment frame linkages.

7.18.2.7 Center Slide Installation

7.18.2.7.1 Install four center slides (424-9272201), used for in-and-out (radial) adjustment of the launch vehicle launch bolt location, on top of the attachment frame over three tiedown studs (424-9272207).

The center slides have been modified according to 424-9272201-003.

7.18.2.8 Forward and Rear Flexure Plate Installation

7.18.2.8.1 Install four rear flexure plates (424-9272205) and eight forward flexure plates (424-9272205) onto the top slides (424-9272201) before installing top slides onto the thrust mount.

7.18.2.8.2 Use attaching hardware and locking devices as detailed on 424-9272200.

7.18.2.8.3 The top slides have been modified according to 424-9272201-001. The top slide is used for adjustment of the attaching bolt location in the horizontal plane in a direction perpendicular to the movement of the center slide (tangential).

7.18.2.9 Top Slide Installation

Install the four top slides (424-9272201) on the tops of the center slides over three tiedown studs.

7.18.2.10 Attachment Head Installation

Secure attachment heads (424-9272201) to the tops of the forward and rear flexure plates at four locations. (The attachment heads include the four air vehicle support points.)

7.18.2.11 Separation Nut Catcher Attachment

7.18.2.11.1 Attach the separation nut catchers (424-9272213) to the top slides at four locations.

7.18.2.12 Attachment Frame Cover Mounting

7.18.2.12.1 Mount attachment frame covers on the four attachment frame heads.

The attachment frame covers have been modified according to 424-9272205-009.

7.18.2.13 Expendable Sleeve Installation

7.18.2.13.1 Install expendable sleeves (424-9272208) into the holes in the air vehicle attaching bolt support points on the attachment heads.

7.18.2.14 Welding of Joints Between Box Struts and Turnbuckles

7.18.2.14.1 Weld the joints between the box struts and the turnbuckles on the four attachment frame assemblies as shown by 424-9272200.

7.18.2.15 Flame Shield Installation

7.18.2.15.1 Install flame shields (424-9272211) on load distribution ring and on A-frames of the attachment frame assemblies.

The existing side flame shield designed for Titan II and used on the inside diameter surface of the load distribution ring is utilized without modification, except as required by the manner of attachment to the flame shield on the horizontal surface of the load distribution ring.

7.18.2.16 Maintenance Platform Installation

7.18.2.16.1 Install the maintenance platform (424-9272209) on the top surface of the load distribution ring.

7.18.3 Checkout Procedure

This is a brief and general description of the principal elements of the checkout procedure for the Stage I thrust mount. A complete description is given in 424-490/AMR, Test Procedure, BLH Thrust and Weight Measuring System Calibration; and in 424-1035/AMR Ground System Test Procedure, Thrust Mount, Stage I.

7.18.3.1 Functional Test

7.18.3.1.1 Adjust alignment so that no mechanical interference exists at the load struts.

7.18.3.1.2 Balance the load distribution ring on the four vertical load struts.

7.18.3.1.3 Check and calibrate the digital readout weight system.

7.18.3.1.4 Check the six component output channels.

7.18.3.1.5 Calibrate the vertical component or thrust channel in pounds/millivolt.

7.18.3.1.6 Calibrate the output channels for the moments about the vertical axis and about the two axes in the horizontal plane in foot pounds/millivolt.

7.18.3.1.7 Calibrate the output channels for forces along the two axes in the horizontal plane in pounds/millivolt.

NOTE: This checkout and calibration procedure must be repeated after every static firing on this mount.

7.18.4 Documentation

Document No.	Title
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-9272000	Installation, Thrust Mount, Stage I
BLH E-503	Load Distribution Ring
BLH E-517	Mounting Bracket, Vertical Load Strut
BLH E-518	Mounting Bracket, Horizontal Load Strut
BLH E-519	Tiedown Bracket
BLH E-521	Flame Shield, Vertical Load Struts
424-9272008	Test Specification, Thrust Mount, Stage I
424-9272010	Drawing Index, BLH Thrust Mount, Complete Missile
424-9272200	Attachment Frame Assembly, Thrust Mount, Stage I
424-9272201	Attachment Frame, Slide Details
424-9272202	Adjustment Frame Linkage
424-9272203	Attachment Frame Legs
424-9272204	Attachment Frame Clevis Detail
424-9272205	Attachment Frame Cover and Flexure Details

Document No.	Title
424-9272206	Attachment Frame Apex Weldment
424-9272207	Attachment Frame, Slide Details
424-9272208	Expendable Sleeve
424-9272209	Maintenance Platform, 9-Foot 8-Inch Elevation
424-9272210	Load Supports
424-9272211	Flame Shields
424-9272213	Catcher, Separation Nut
424-9272300	Attachment Frame, Slide Details
424-9272302	Foot Clevis
424-9272303	Bumper, Explosive Nut
424-490/AMR	Test Procedure, BLH Thrust and Weight Measuring System Calibration
424-1035/AMR	Ground System Test Procedure, Thrust Mount, Stage I

7.19 STAGE II THRUST MOUNT INSTALLATION

7.19.1 Description

The Stage II thrust mount supports the launch vehicle Stage II while it is being prepared for and during sequential compatibility firings (Fig. 7-64). The structure mates with the stage separation plane and is capable of supporting Stage II during static firings. The structure also provides an access to the thrust chamber and engine compartment of Stage II.

7.19.2 Sequence of Events

7.19.2.1 Existing Equipment Utilization

7.19.2.1.1 Utilize the existing load distribution ring (Baldwin-Lima-Hamilton (BLH) Drawing E-524), four vertical and three horizontal load struts (BLH Drawing E-526), four tiedown brackets (BLH Drawing E-528) and flame shield (BLH Drawing E-529), all of Titan I design, without modification.

7.19.2.2 Attachment Frame Assembly Column Installation

7.19.2.2.1 Install four attachment frame assemblies (Part No. 424-9282002-009).

The equally spaced columns are oriented 45 degrees from the target and welded to the load distribution ring.

7.19.2.3 Adapter Ring Installation

7.19.2.3.1 Bolt the adapter ring (Part No. 424-9282001-009) to the top of the four columns, inserting shims if necessary, so that the tops of the four columns are level and coplanar (Fig. 7-64).

7.19.2.4 Work Platform Installation

7.19.2.4.1 Install work platforms 65-5/16 inches above the upper horizontal surface of the load distribution ring (Fig. 7-64).

These platforms provide access to the launch vehicle engine compartment. The platforms are supported by structural steel angles welded horizontally on each side of the four columns. The platform is composed of eight units of prefabricated floor with a working surface of safety plate. Four units of the platform are bolted to the horizontal supports. The other four units are hinged to the stationary sections of the platform. These movable sections are rigid when in a horizontal position and may be raised through 180 degrees to an inverted position for static firings.

7.19.2.5 Handrail Installation

7.19.2.5.1 Install handrail assembly on the north platform section (Fig. 7-64).

The handrail assembly is bolted to the platform. The two sections of the handrail are symmetrical about the centerline of the north platform, and there is an access way at the center between the two sections. The access way is bridged by two safety chains. A handrail is provided along the east, south and west platforms when the erector is in a vertical position. With the erector down, the east, south and west platform edges are unguarded.

7.19.2.6 Portable Ladder Installation

7.19.2.6.1 Install a portable ladder for access to the work platform only when the erector is down (Fig. 7-64).

The ladder extends from the upper surface of the load distribution ring to the surface of the work platform. The ladder is attached to the work platform by two dowel pins. The ladder may be used on either the east or west side of the platform when the erector is down.

7.19.2.7 Flame Shield Installation

7.19.2.7.1 Install flame shields Part Nos. 422-9282026-009 through 424-9282026-059 in accordance with Drawing 424-9282025 (see Section A-A in Fig. 7-64).

Each flame shield is composed of three segments--one segment on the inner face and one on each side of the column. The flame shield panels are bolted to supporting channels welded to the attachment frame assembly. The space between each flame shield panel and column is filled with fiber glass insulation.

7.19.2.8 Flame Shield Installation, Top and Bottom (horizontal surfaces) and Inside Vertical Surface (load distribution ring)

7.19.2.8.1 Install flame shields on the top and bottom horizontal surfaces and on the inside diameter, vertical surface of the load distribution ring.

The bottom surface flame shield is composed of 20 segments attached by bolts to three steel channels welded to the load distribution ring.

The inside diameter surface flame shield is composed of 16 segments attached by bolts to two steel channel rings welded to the inside diameter surface.

The top surface flame shield is composed of 16 segments attached to the top of the deck grating by long bolts extending through the deck grating to the load distribution ring. Four segments fit between each pair of adjacent attachment frame assembly columns. The joints between the top surface flame shields and the column flame shields are secured by bolts and/or welding. Details of installation are given in BLH Drawing E-529.

7.19.3 Checkout Procedure

Detailed procedures are contained in Ground System Test Procedure, Thrust Mount, Stage II, 424-1036/AMR, and Test Procedure, BLH Thrust and Weight Measuring System Calibration, 424-490/AMR.

The following is a brief description of the test procedures.

7.19.3.1 Functional Test

7.19.3.1.1 Adjust alignment so that no mechanical interference exists at the load struts.

7.19.3.1.2 Balance the load distribution ring on the four vertical load struts.

7.19.3.1.3 Check and calibrate the digital readout weight system.

7.19.3.1.4 Check the six component output channels.

7.19.3.1.5 Calibrate the vertical component or thrust channel in pounds per millivolt.

7.19.3.1.6 Calibrate the output channels for the moments about the vertical axis and about the two axes in the horizontal plane in foot pounds per millivolt.

7.19.3.1.7 Calibrate the output channels for forces along the two axes in the horizontal plane in pounds per millivolt.

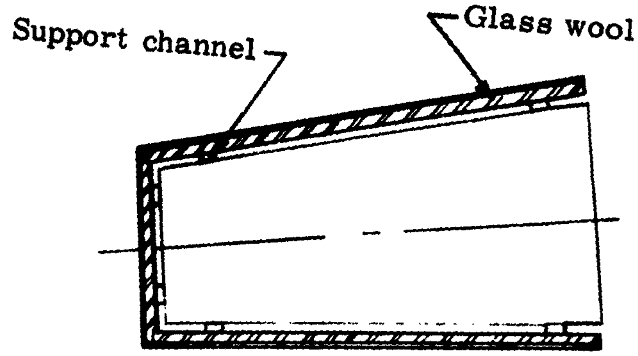
NOTE: This checkout and calibration procedure must be repeated after every static firing on this thrust mount is completed.

7.19.4 Documentation

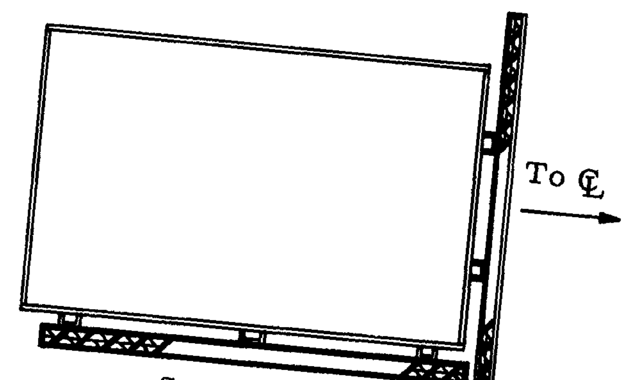
Document No.	Title
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-9282000	Installation, Thrust Mount, Stage II, Baldwin-Lima-Hamilton E-524, Load Distribution Ring
*BLH E-526	Load Struts
*BLH E-527	Horizontal Load Strut Base
*BLH E-528	Tiedown Brackets
*BLH E-529	Vertical Load Strut Base and Flame Shield
424-9282002	Attachment Frame, Assembly Column
424-9282001	Adapter Ring
424-9282025	Flame Shield Installation
424-9282050	Platform Assembly and Installation
424-9282055	Platform Supports Installation
424-9282015	Bracket Installation

*BLH thrust and weight measuring system.

Document No.	Title
424-9282026	Flame Shield Assembly, Thrust Mount
424-490/AMR	Test Procedure, Baldwin-Lima-Hamilton Thrust and Weight Measuring System Calibration
424-1036/AMR	Ground System Test Procedure, Thrust Mount, Stage II



Section A-A
Flame shield
Typical for each leg



Section B-B

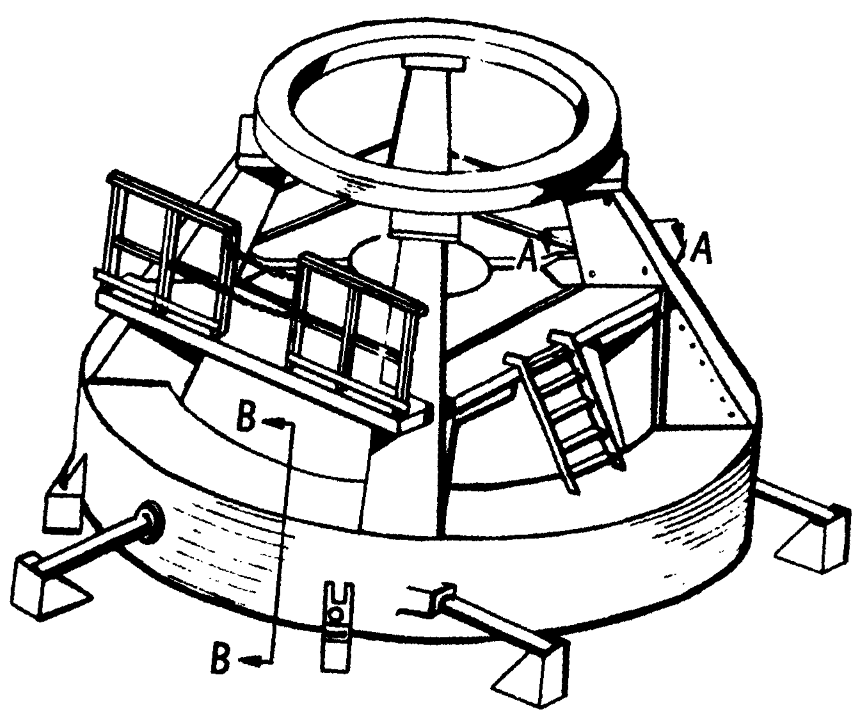


Fig. 7-64. Thrust Mount, Stage II

7.20 WATER DELUGE SYSTEM INSTALLATION, TEST STAND, STAGE I

7.20.1 Description

A Water Distribution and Spray System is provided at the Stage I test stand to dissipate the heat resulting from a normal launch and during engine shutdown, to combat engine compartment fire conditions, to aid in washing propellant spillage from the stand area and to provide water to the engine cleaning and purging units.

The system consists of a primary water header feed from the 36-inch process water main (facility), which provides the cooling and fire-combating water to the nozzles; and a secondary supply feed from the 18-inch domestic water main (facility), which provides water to the engine cleaning and purging units and to a secondary header used to fill the fire combating fog nozzle candelabra.

Water to the primary header is initially controlled by a facility valve in the header feed. Control of water to the fog nozzle candelabras is exercised by individual nitrogen actuated valves. The secondary supply feed is manually controlled, since it is used only during test preparation, engine cleaning and purging. Sensing pressure switches (transducers) indicate, on the water console, the go-no-go conditions of water pressure in the water supply mains (18-inch domestic and 36-inch process) and the water pressure to the flame bucket.

Figure 7-65 schematically shows the installation of the AGE system.

7.20.2 Sequence of Events

7.20.2.1 Primary Header Assembly Installation

7.20.2.1.1 Erect a temporary work platform across the opening of the thrust mount.

7.20.2.1.2 Establish the launch stand north-south and east-west axes on the platform. The intersection point obtained is the turning point (TP) for the transit.

7.20.2.1.3 Lay out the primary header pipe circle and azimuth lines for reference and location purposes and complete the primary header assembly installation according to Drawing 424-4702000, Piping Installation Water System, Test Stand.

(1) Lay out in plan on the deck the entire primary header run, including offsets, location of run-out connections for nozzle supply, feed connection and position of pipe standards.

(2) Develop the length of all header curved pipe sections.

(3) Fabricate to the development using required pipe sizes. Drill holes at runout connection locations, where practical.

(4) Anchor the prefabricated pipe support standards for the primary header and the candelabra piping support in accordance with Drawing 424-4702000.

(5) Assemble sections of the spray header to handling size and position in place on the thrust mount header support.

(6) Weld the header subassembly sections in place and complete the header installation.

(7) Position the supply connecting boot for flange connection to the facility water supply and weld to the header inlet opening.

(8) Weld all nozzle runout couplings to the header, providing additional runout-to-header openings as required and install unions and diaphragm valves, as indicated.

(9) Complete the installation and welding of runouts to the point of nozzle installation, but do not install nozzles until the leak tests are completed.

7.20.2.2 Secondary Header Assembly Installation

7.20.2.2.1 Install Secondary Header Assembly in accordance with Drawing 424-4702000 Piping Installation Water System, Test Stand.

(1) Using referenced drawing, locate and weld to the primary spray header all angle iron secondary header pipe standards.

(2) Isolate and drain the section of 18-inch main (facility) adjacent to the Stage I stand and provide for a 3-inch weldolet secondary header tap.

(3) Install manual shutoff valvé so that the main may be returned to service.

(4) Fabricate and install all 3-inch piping between the valve and the low pressure filter and from the filter to valved runouts which provide service to the engine cleaning and purge unit.

(5) Install 1-1/2-inch piping to the AGE/facility interface.

(6) Locate and weld all 1-inch threadolet connections to the 3-inch candelabra runouts.

(7) Assemble sections of the candelabra nozzle fill piping (1- and 1-1/2-inch sizes) and install above the main spray header to the pipe standards previously placed.

(8) Complete the runouts between the fill header and the candelabra threadolets.

7.20.2.3 Pressure Switch (transducer) Installation

7.20.2.3.1 During dry conditions in the 18- and 36-inch mains, install pressure switches and complete the tubing runouts from the valves to the pressure switches, providing fittings for N_2 connections according to Drawing 424-4702000, Piping Installation Water Systems, AMR.

7.20.3 Checkout Procedure

A detailed description of the checkout procedure is contained in GSTP 1034/AMR. A brief description of the procedure follows.

7.20.3.1 Functional Test

7.20.3.1.1 Apply test pressure to the primary header system connected to the 36-inch main.

(1) To accomplish the system test, cap all swaged fittings except one at the nozzle installation points (fit one to permit introduction of air or nitrogen for pressurizing) and install a blank closure at the Martin/COE connecting flanges.

(2) Close all valves where fill lines connect to the nozzle runouts or open and plug lines at union connections.

(3) Manually open all diaphragm valves. Establish the test pressure in the system and proceed to leak test all joints (welded and threaded), using a soapy water solution.

7.20.3.1.2 Apply a test pressure to the secondary water supply system connected to the 18-inch main.

(1) To accomplish this system test, install a blank flange closure between the 18-inch main and the 3-inch flanged shutoff valve.

(2) Utilize the primary system under a test pressure to introduce a test medium to the remaining system being tested.

(3) Leak test all joints, using the soapy water solution.

7.20.3.1.3 Accomplish leak testing of transducer tubing at the time of the pressure-switch calibration check, when nitrogen is used in these systems.

(1) These lines should be plugged at the main connection and flame bucket connection points.

7.20.4 Documentation

Drawing No.	Title
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-4702000	Piping Installation, Water System, Test Stand, Stage I

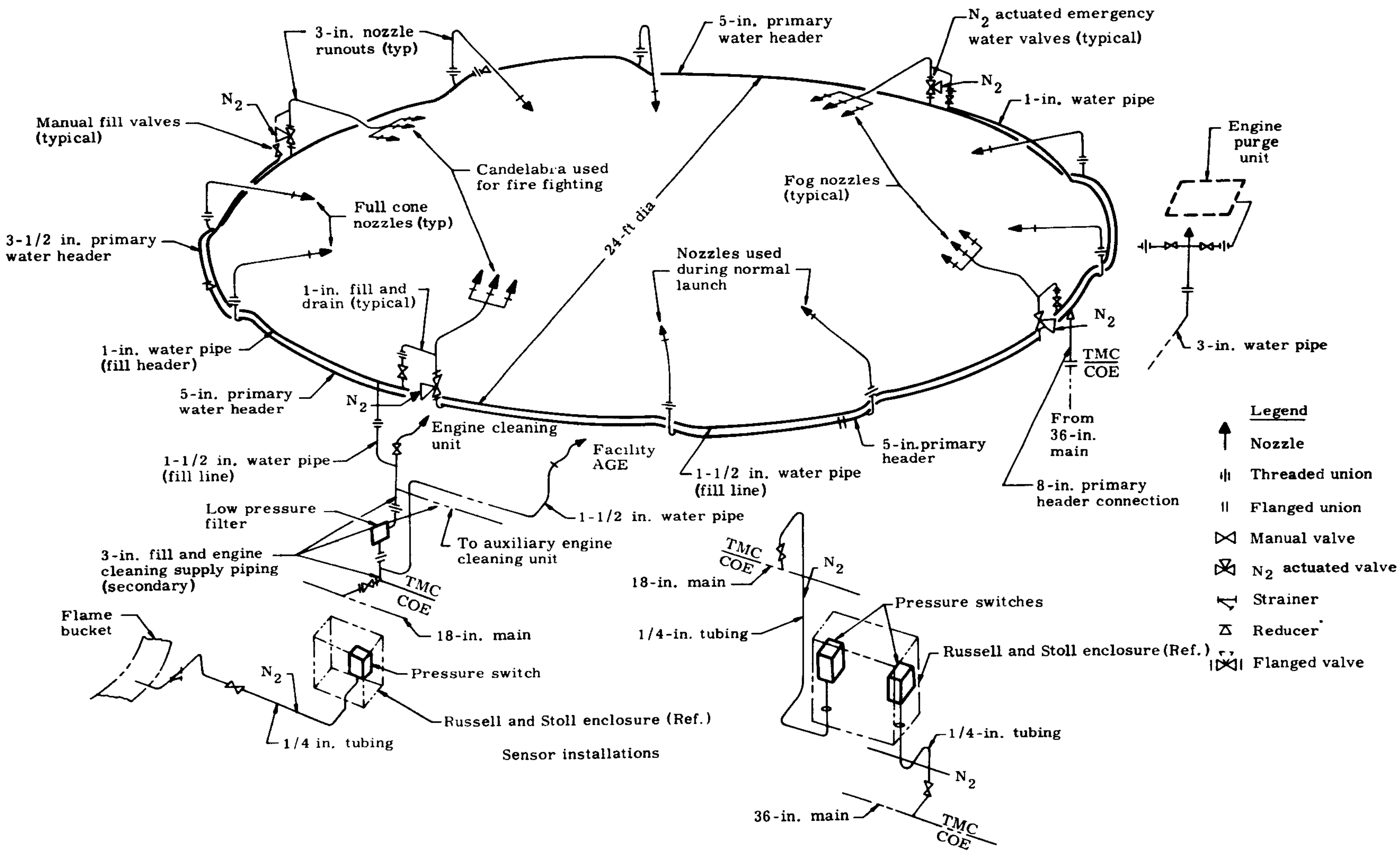


Fig. 7-65. Piping Installation Water System Test Stand, Stage I

7.21 WATER DELUGE SYSTEM INSTALLATION, TEST STAND, STAGE II

7.21.1 Description

A Water Distribution and Spray System is provided at the Stage II test stand to dissipate the heat resulting from static firing tests during and after engine runs, to combat engine compartment fire conditions, to aid in washing propellant spillage from the stand area, and to provide water to the engine cleaning unit.

The system consists of a primary water header feed from the 36-inch process water main (facility) which provides the cooling and fire-combating water to the nozzles, and a secondary supply feed from the 18-inch domestic water main (facility) which provides water to the engine cleaning unit and to a secondary header used to fill the fire-combating fog nozzle candelabra.

Water to the primary header is initially controlled by a facility valve in the header feed. Control of water to the fog nozzle candelabra is exercised by individual nitrogen-activated valves. The secondary supply feed is manually controlled, since it is used only during test preparation and engine cleaning. A sensing pressure switch indicates, on the water console, the go/no-go conditions of water pressure to the flame bucket. Pressure conditions in the water mains are registered at the water console by pressure switches discussed in Section 7.20.

Figure 7-66 schematically shows the installation of the AGE system.

7.21.2 Sequence of Events

7.21.2.1 Primary Header Assembly Installation

7.21.2.1.1 Erect a temporary work platform across the opening of the thrust mount.

7.21.2.1.2 Establish the launch stand north-south and east-west axes on the platform. The intersection point obtained is the turning point (TP) for the transit.

7.21.2.1.3 Lay out the primary header pipe circle and azimuth lines for reference and location purposes and complete the primary header assembly in accordance with Drawing 424-4740005, Piping Installation, Water System, Test Stand.

(1) Lay out in plan on the deck the entire primary header run, including offsets, location of run-out connections for nozzle supply, feed connection and position of pipe standards.

(2) Develop the length of all header curved pipe sections.

(3) Fabricate to the development, using required pipe sizes. Drill holes at runout connection locations, where practical.

(4) Anchor the prefabricated pipe support standards for the primary header and the candelabra piping support in accordance with Drawing 424-4740005.

(5) Assemble sections of the spray header to handling size and position in place on the thrust mount header support.

(6) Weld the header subassembly sections in place and complete header installation.

(7) Position the supply connecting boot for flange connection to the facility water supply and weld to the header inlet opening.

(8) Weld all nozzle runout couplings to the header, providing additional runout-to-header openings as required and install unions and diaphragm valves, as indicated.

(9) Complete the installation and welding of runouts to the point of nozzle installation, but do not install nozzles until the leak tests are completed.

7.21.2.2 Secondary Header Assembly Installation

7.21.2.2.1 Install secondary header assembly in accordance with Drawing 424-4740005.

(1) Using referenced drawing, install all secondary header piping supports.

(2) Isolate and drain the section of 18-inch main (facility) adjacent to the Stage II stand and provide for a 3-inch weldolet secondary header tap.

(3) Install a manual shutoff valve so that the main may be returned to service.

(4) Fabricate and install all 3-inch piping between the valve and the low-pressure filter and from the filter to the valved runouts which provide service to the engine cleaning unit.

(5) Install 1-1/2-inch piping to the AGE/facility interface.

(6) Weld all 1-inch threadolet connections to the 3-inch candelabra runouts.

(7) Assemble sections of the candelabra nozzle fill piping (1- and 1-1/2-inch size) and install to the pipe standards previously placed.

(8) Complete the runouts between the fill header and the candelabra threadolets.

7.21.2.3 Pressure Switch (Transducer) Installation

7.21.2.3.1 Tap a pressure hole in the flame bucket heel and weld a 7-inch coupling connection.

7.21.2.3.2 Install the pressure switch and install a 1/4-inch tubing runout from the coupling to the switch, providing a fitting for the N_2 connection.

7.21.3 Checkout Procedure

A detailed description of the checkout procedure is given in GSTP 1034/AMR. A brief description follows.

7.21.3.1 Functional Test

7.21.3.1.1 Apply test pressure to the primary header system connected to the 36-inch main.

(1) To accomplish the system test, cap all swaged fittings except one at the nozzle installation points (fit one to permit introduction of air or nitrogen for pressurizing) and install a blank closure at the Martin/COE connecting flanges.

(2) Close all valves where fill lines connect to the nozzle runouts or open and plug lines at union connections.

(3) Manually open all diaphragm valves. Establish the test pressure on the system and proceed to leak-test all joints (welded and threaded), using a soapy water solution.

7.21.3.1.2 Apply a test pressure to the secondary water supply system connected to the 18-inch main.

(1) To accomplish this system test, install a blank flange closure between the 18-inch main and the 3-inch flanged shutoff valve.

(2) Utilize the primary system under a test pressure to introduce a test medium to the remaining system being tested.

(3) Leak-test all joints, using the soapy water solution.

7.21.3.1.3 Accomplish leak testing of transducer tubing at the time of the pressure-switch calibration check when nitrogen is used in the system.

(1) The line is plugged at the flame bucket connection point.

7.21.4 Documentation

Drawing No.	Title
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-4740005	Design Specification, Water Deluge System, Stage II
424-	Piping Installation, Water System, Test Stand, Stage II

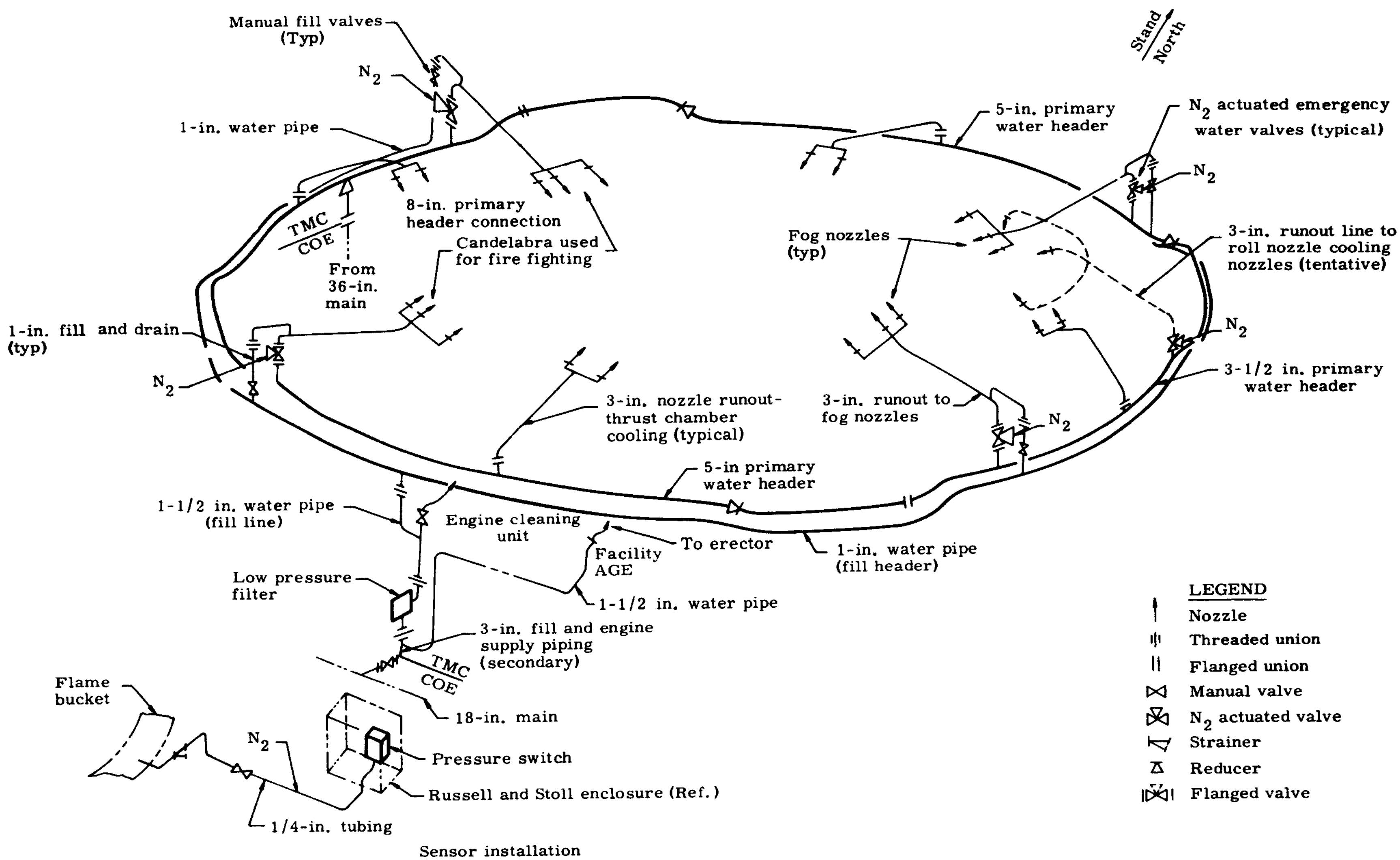


Fig. 7-66. Piping Installation Water System Test Stand, Stage II

7.22 RF TRANSMISSION SYSTEM INSTALLATION (CP 5791)

7.22.1 Description

7.22.1.1 Functional Description

The RF transmission system is used for sending RF signals between launch vehicle systems and AGE during airborne RF equipment checkout, sequenced compatibility firings (SCF) and flight readiness firings (FRF). The presence of RF signals in the frequency range of the command control receivers is monitored.

The following airborne systems are served by the RF transmission system:

(1) MISTRAM transponder.

(2) GE Mod IIIG Radio Guidance System.

(3) Command control receivers.

Transmission is by wave guide for the MISTRAM system, wave guide or air link for the radio guidance system, and coaxial cable for the command control receivers.

Selection of either wave guide line or air link transmission is accomplished by manually positioning the air link RF switch, located near the ABETS unit.

For wave guide transmission, selection of either the complete vehicle location or the Stage II location is accomplished by means of an RF switch mounted in the RF switch box (Location 416).

The ground plane receiver monitor antenna mounted on top of the blockhouse is used for monitoring of RF signals in the complex area for range safety radio frequency radiation. Coaxial cable connects the antenna to the launch vehicle safety No. 1 control (CP 2030), which is located on the second floor of the blockhouse.

A 60-db suppression (minimum) is provided by antenna suppressors into the three unused command control receiver antennas and the one unused GE Mod IIIG Guidance System antenna at each thrust mount position.

The RF transmission system wave guides and coaxial cables, which are pressurized, use dry nitrogen to 5 ± 1 psig to prevent the entrance of moisture and contaminants, such as propellant vapors. A facility 5-psig nitrogen source is used.

Telemetry transmission is excluded from consideration since the RF transmission for this purpose is covered in Section 7.8, Ground Instrumentation Equipment.

7.22.2.2 Component Description

MISTRAM. A wave guide is used to connect the MISTRAM test set in the upper equipment room to the MISTRAM airborne units. Two runs of wave guide are needed from the frequency mixer output of the MISTRAM test set to the RF switches used to route RF transmission to either of the two thrust mount positions. Two runs of wave guide connect the RF switch box to the complete vehicle launch position, and two runs connect the RF switch to the Stage II test position (Fig. 7-67).

ABETS. A single wave guide transmission line connects the ABETS unit in the upper equipment room to the air link RF switch. This switch is joined by one wave guide line to the guidance air link antenna on the launch deck and by another wave guide line to the RF switch box. Single wave guide routes are provided from the RF switch box to each of the two thrust mount locations.

The commercial-type wave guide used is suitable for the X-band frequencies (Drawing 424-5791026, Wave Guide Parts List).

Existing 8- by 12-inch ducting is utilized from the north wall of the actuator room to the platform levels on the erectors where the airborne antennas are located, except for the lengths in which flexible components are used. New ducting serves the platform areas and the RF switch box to the north wall of the actuator room. New ducting also is used for housing the guidance air link wave guide run from the north wall of the upper equipment room to the air link antenna.

Command control. A single coaxial cable connects the command control test set located in the second floor blockhouse control center to the RF switch box. Separate coaxial cables are used from the RF switch box to each of the two thrust mount positions.

The coaxial cable is a semirigid, pressurized, metal-sheathed cable of the styroflex (or equal) type, suitable for operation in L-band frequencies (Drawing 424-5791025, Coaxial Cable Parts List).

The RF transmission system includes various antenna couplers which provide for transfer of RF energy from wave guide and coaxial transmission lines to the appropriate antennas. All antenna couplers are provided with direct-current isolation to prevent ground currents.

Each of the GE Mod IIIG antenna couplers has a flat mounting plate with four thumbscrews for fastening the coupler to the antenna. The plate, which is attached to a section of wave guide, has a rectangular opening into the wave guide (Drawing 424-4696020).

Each of the MISTRAM couplers consists of a segment of X-band wave guide with two mounting brackets and screws attached to the narrow sides of the wave guide. The MISTRAM wave guide antennas extend beyond the outer surface of the launch vehicle and are connected to the couplers by insertion of the couplers. Positive attachment of the couplers is made with mounting screws (Drawing 424-4696019).

Each of the command control system antenna couplers consists, in general terms, of an antenna hat enclosing a probe. The probe is connected to the RF transmission system coaxial cable. The antenna coupler is mounted on the covering of the antenna radome and is fastened with four screws (Drawing 424-4696010).

One of the GE Mod IIIG antennas and three of the command control receiver antennas are not used during SCF or FRF checkout. The unused antennas are shielded by antenna suppressors to reduce leakage and pickup of RF energy by 60 db (minimum). The suppressors are similar to the corresponding couplers and are mounted in the same way.

Solenoid-operated RF switches are used for selection of RF signal routing to either the Stage II test location or to the complete vehicle launch location and are mounted in the RF switch box. Wave guide switches are provided for the MISTRAM and guidance systems; a coaxial switch is provided for the command control system.

The 52- by 52- by 18-inch RF switch box is located in the northwest corner of the transfer room in the approach ramp building. This area of the upper equipment room is open to the transfer room which is directly underneath. For convenience, control of the switch solenoids and, hence, switch position is executed at the RF switch panel. The RF switch panel is mounted, along with other AGE, in patch panel PP2A, located in the northwest corner of the transfer room. Control signals are routed to the RF switch box through cables (Drawing 424-5791014).

Each of the RF switches connects the input of the switch to one of two switch output transmission lines. To ensure pressurization of the output lines, the input of each switch is connected to both output lines via a hose assembly.

Each of the command receiver control coaxial cables connecting the thrust mount locations and the RF junction box has an unpressurized flexible section. A hose assembly maintains nitrogen pressurization in the sections downstream of the unpressurized flexible sections.

The radio guidance wave guide transmission line to the air link antenna and the ABETS unit is pressurized by connection to the nitrogen supply and a hose assembly which acts as a jumper around the air link RF switch.

7.22.2 Sequence of Events

7.22.2.1 RF Switch Box Installation

7.22.2.1.1 Install RF switch box in the approach ramp building (Location 416) in accordance with Drawing 424-2050400, RF transmission system installation.

(1) The RF switch box contains switches for the following lines:

(a) Command control coaxial cable.

(b) MISTRAM wave guide.

(c) GE radio guidance wave guide.

7.22.2.2 Patch Rack PP2A Utilization

7.22.2.2.1 Utilize patch rack PP2A (Location 2) and RF switch panel. Utilize Drawings 424-9501370, PP2A Patch Rack and 424-5791022, RF Switch Panel, to accomplish the proper connections.

7.22.2.3 Cable M36 Utilization

7.22.2.3.1 Utilize cable M36 (Drawing 424-9501070) to connect the RF switch box and the RF switch panel installed as part of launch vehicle safety system.

7.22.2.4 Air Link Installation

7.22.2.4.1 Install air link antenna on the Stage II Umbilical Tower, wave guide and ducting in accordance with Drawings 424-2050400, RF Transmission System Installation; 424-2052300, GE Antenna and Ducting Installation; and 424-5791027, Mod IIIG Radio Guidance RF System, AMR.

(1) The wave guide connects the air link antenna on the launch deck to the air link RF switch.

7.22.2.5 Air Link RF Switch Installation

7.22.2.5.1 Install air link RF switch in accordance with Drawings 424-2050400, RF Transmission System Installation and 424-5791027, Mod IIIG Radio Guidance RF System, AMR.

7.22.2.6 New Ducting Installation for RF Switch Box

7.22.2.6.1 Install new ducting to connect the RF switch box to existing wave guide ducting at the north wall of the actuator room in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.2.7 Antenna Level Ducting Installation

7.22.2.7.1 Install ducting on the complete vehicle erector and on Stage II erector in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.2.8 MISTRAM Checker-to-Erectors Wave Guide Installation

7.22.2.8.1 Install two runs of both rigid and flexible wave guides (Drawing 424-2050400) from the MISTRAM checker through the MISTRAM wave guide switch in the RF switch box, and run one line from each of these two lines to interfaces in the CVE and the Stage II erector.

NOTE: The wave guides described comprise the "fixed" system.

7.22.2.8.2 From the four interfaces (7.22.2.8.1) in the CVE and Stage II erector, install four runs of flexible wave guides to the MISTRAM equipment interface coupling in the launch vehicle.

NOTE: The wave guides described comprise the "removable" system.

7.22.2.9 ABETS-to-Erectors Wave Guide Installation

7.22.2.9.1 Install one run of both rigid and flexible wave guide (Drawing 424-2050400) from the ABETS through the air link RF switch to the GE radio guidance wave guide switch in the RF switch box.

7.22.2.9.2 From the RF switch box, run one line of both rigid and flexible wave guide to an interface in the CVE and run another line to an interface in the Stage II erector.

NOTE: The wave guides described comprise the "fixed" system.

7.22.2.9.3 From the two interfaces (7.22.2.9.2) in the CVE and Stage II erector, install two runs of flexible wave guide to the GE Radio Guidance equipment interface coupling in the launch vehicle.

NOTE: The wave guides described comprise the "removable" system.

7.22.2.10 Nitrogen Pressurization Installation, Wave Guide to ABETS

7.22.2.10.1 Install the nitrogen pressurization connection from wave guide sections to ABETS in accordance with Drawings 424-2050400, RF Transmission System Installation and 424-9154000, N_2 Piping System Installation.

7.22.2.11 Nitrogen Pressurization Installation, Wave Guide Sections to MISTRAM

7.22.2.11.1 Install the nitrogen pressurization connection from wave guide sections to MISTRAM in accordance with Drawings 424-2050400, RF Transmission System Installation and 424-9154000, N_2 Piping System Installation.

7.22.2.12 Nitrogen Hose Installation, ABETS Air Link Switch

7.22.2.12.1 Install nitrogen hose assembly around air link switch for ABETS in accordance with Drawings 424-2050400, RF Transmission System Installation; 424-9154000, N_2 Piping System Installation; and 424-5701027, Mod IIIG Radio Guidance RF System, AMR.

Command control coaxial cable installation. The RF transmission system provides coaxial cable to connect the receiver monitor antenna to the launch vehicle safety No. 1 control rack (CP 2030) on the second floor of the blockhouse. The cable originates at the antenna, passes through the blockhouse roof via an existing periscope standpipe, and extends approximately 45 feet at ceiling level to the rack.

The command receiver control rack (CP 2020) is located adjacent to the launch vehicle safety control No. 1 rack. Coaxial cable is routed through the blockhouse cable trays from the command receiver control rack to one end of an existing coaxial cable, approximately two feet inside the blockhouse, near the blockhouse end of the tunnel. The existing segment of coaxial cable extends from this point through the tunnel and first floor of the approach ramp building to the nitrogen pressurization coupling adapter near the RF switch box. This adapter is connected to the RF switch box by 7/8-inch (OD) styroflex.

Two coaxial cables--one for each thrust mount position--connect the RF switch box to the antenna couplers. The two runs go through the same ducting used for the ABETS and MISTRAM wave guide runs from the RF switch box to the antenna level at the test and launch locations (Drawing 424-5791025).

7.22.2.13 Monitor Receiver Antenna Installation

7.22.2.13.1 Install the monitor receiver antenna on the blockhouse roof in accordance with Drawing 424-2051000, AGE, Blockhouse, Complete--Complex 19.

7.22.2.14 Coaxial Cable Installation

7.22.2.14.1 Install the coaxial cable assemblies in accordance with Drawing 424-2050400, RF Transmission System Installation.

(1) Install coaxial cable from the monitor antenna to the launch vehicle safety control No. 1 rack.

(2) Install coaxial cable from the command receiver control rack to the existing coaxial cable which runs to the RF switch box.

(3) Install two coaxial cables, one to each of the erectors from the command control coaxial switch in the RF switch box. Cables in the erectors must reach the radio guidance equipment interface in the launch vehicle.

7.22.2.15 Styroflex Coaxial Cable Installation

7.22.2.15.1 Install the styroflex coaxial cable in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.2.16 Coaxial Adapter Installation

7.22.2.16.1 Install the coaxial adapters in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.2.17 Coaxial Cable Hose Assembly Installation

7.22.2.17.1 Install the coaxial cable hose assemblies in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.2.18 Coaxial Cable Nitrogen Pressurization Coupling Adapter Installation

7.22.2.18.1 Install the coaxial cable nitrogen pressurization coupling adapter in accordance with Drawings 424-2050400, RF Transmission System Installation and 424-9154000, N_2 Piping System Installation.

7.22.2.19 Coaxial Cable Antenna Coupler Connector Adapter Installation

7.22.2.19.1 Install coaxial cable antenna coupler connector adapters in accordance with Drawings 424-2050400, RF Transmission System Installation and 424-9154000, N_2 Piping System Installation.

7.22.2.20 Duct Cover Installation

7.22.2.20.1 Install duct covers in accordance with Drawing 424-2050400, RF Transmission System Installation.

7.22.3 Checkout Procedure

7.22.3.1 Functional Test

7.22.3.1.1 Verify that the wave guide and styroflex cable pressurization leakage is within acceptance limits.

7.22.3.1.2 Verify that the dielectric leakage resistance of the coaxial lines is within acceptance limits.

7.22.3.1.3 Verify that the attenuation at specified frequencies of the RF signals transmitted by the wave guides and by the coaxial cables is within acceptance limits.

7.22.3.1.4 Verify that the voltage standing wave ratio (VSWR) at specified frequencies of the RF signals transmitted by the MISTRAM wave guides, the guidance wave guide, and the coaxial cables is within acceptance limits.

Detailed test procedures will be found in Test Procedures, 424-587/AMR, and Ground Systems Test Procedure, 424-1032/AMR.

7.22.4 Documentation

Document No.	Title
424-2050400	RF Transmission System Installation
424-5791025	Command Control RF System, AMR
424-5791026	MISTRAM RF System, AMR
424-5791027	Mod IIIG Radio Guidance RF System, AMR
424-4696010	Antenna Hat and Suppressor Assembly, Command Control
424-4696019	MISTRAM Antenna Coupler
424-4696020	GE Mod IIIG Antenna Coupler
424-4696030	RF Switch Box
424-4696045	RF Switch Box Wiring
424-9501370	PP2A Patch Rack
424-9501070	Patch Rack Cable
424-5791022	RF Switch Panel
424-5791100	RF Transmission System
424-1715003	Design Criteria for RF Transmission System, AMR
424-587/AMR	RF Transmission System Calibration
424-1032/AMR	Ground Systems Test Procedure
424-2052300	GE Antenna Wave Guide and Ducting Installation
424-9154000	N_2 Piping System Installation
327-4652018	Monitor Receiver Antenna
424-2051000	AGE Blockhouse Complete, Complex 19

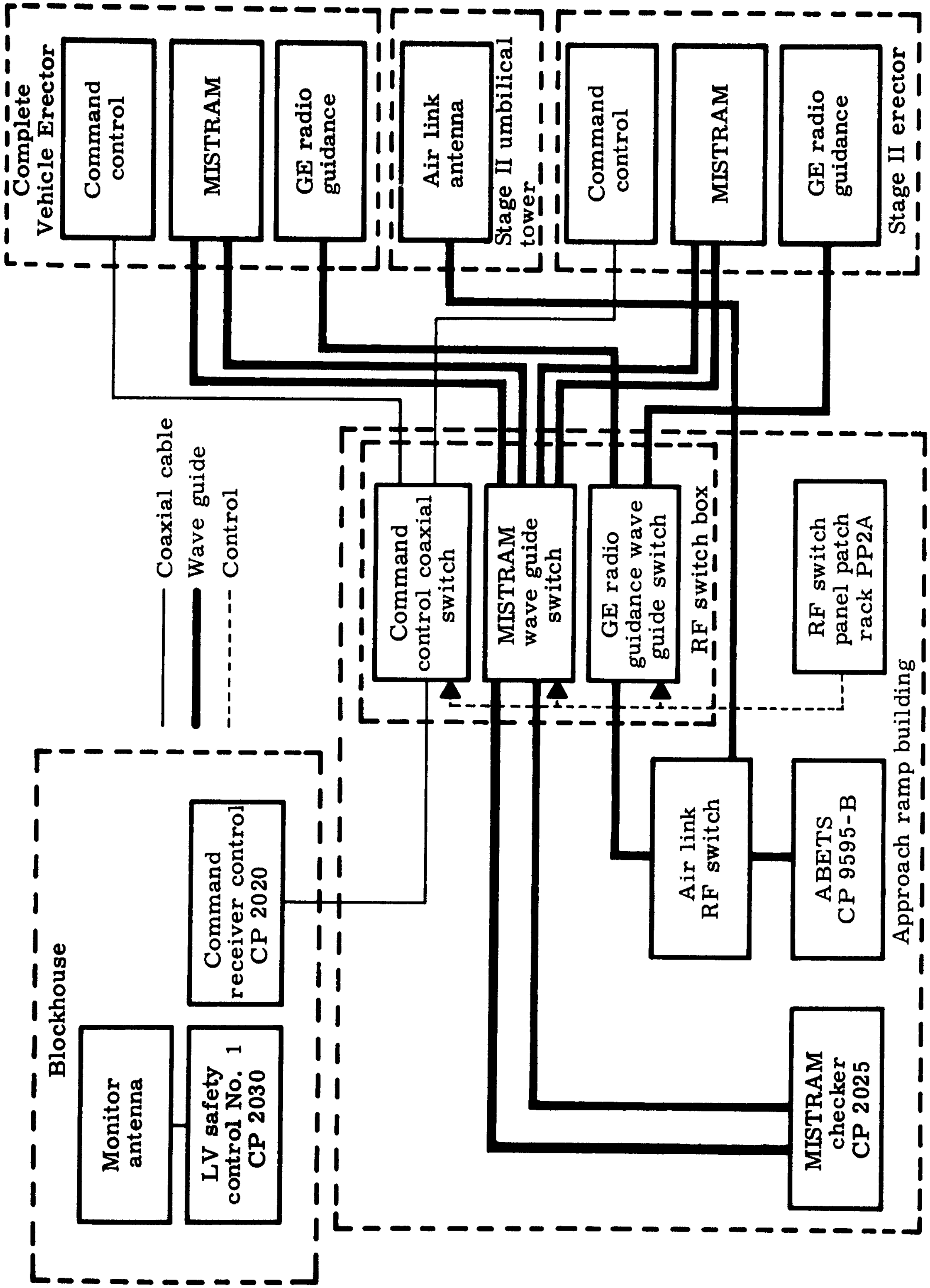


Fig. 7-67. RF Transmission System Schematic

7.23 STABILIZING LINE SYSTEM INSTALLATION

7.23.1 Description

The Stabilizing Line System consists of equipment for the support and alignment of the launch vehicle while in either the horizontal or vertical position in the erectors.

The stabilizing line installation is presented in the following three parts:

(1) Stabilizing line installation, Stage I, complete vehicle erector (CVE) (Fig. 7-68).

(2) Stabilizing line installation, Stage II, complete vehicle erector (CVE) (Fig. 7-69).

(3) Stabilizing line installation, Stage II, Stage II erector (Fig. 7-70).

7.23.2 Sequence of Events

7.23.2.1 Stage I Stabilizing Line Installation, CVE

The installation of the columns, guide carriage assemblies, and various brackets which are secured to the CVE for attaching the cables and slings used to stabilize and align the launch vehicle Stage I in the CVE is shown in Drawing 424-9592011 (Fig. 7-68).

7.23.2.1.1 Weld the two guide beam assemblies (Drawing 424-9592022) in a vertical position between the work platforms at elevations of 15 feet, 6 inches and 26 feet, 7 inches.

7.23.2.1.2 Install one guide carriage assembly (Drawing 424-9592015) on each of the two guide beam assemblies, using eight roller bearings for each guide carriage, as shown in Drawing 424-9592011.

The launch vehicle Stage I longerons attach by cables to the guide carriages.

7.23.2.1.3 Install, at an elevation of 66 feet, 1-13/16 inches, the brackets, etc., used to attach the lateral support cables of the upper handling ring for Stage I, as shown in Drawing 424-9592011.

7.23.2.1.4 Weld the brackets (Drawing 424-9592016), to which the upper and the lower wind support assembly (Drawing 424-9592028) cables attach, to four vertical columns at elevations of 73 feet, 6 inches and 80 feet, 8 inches as shown in Drawing 424-9592011.

7.23.2.1.5 Attach four monorail track assemblies to the underside of the movable platform sections at an elevation of 70 feet, 2-13/16 inches, as shown in Drawings 424-9592050-009 and 424-9592011. These tracks support the four hoist assemblies by which the upper handling ring halves may be lowered to the work platform at an elevation of 60 feet, 5-13/16 inches after removal from the launch vehicle Stage I.

7.23.2.1.6 Install the location plate (Drawing 424-9592018-001), "Centerline Aft Wheel Transtainer Stage I" on the transtainer track with the indicator arrow at an elevation of 26 feet, 1/2 inch, as shown in Drawing 424-9592011.

7.23.2.2 Stage II Stabilizing Line Installation, CVE

The installation of the columns, guide carriage assemblies, monorail track assemblies, and various brackets which are secured to the CVE for attaching the cables and slings used to stabilize and align the launch vehicle Stage II in the CVE is shown in Drawing 424-9592012 (Fig. 7-69).

7.23.2.2.1 Install the two guide beam assemblies (Drawing 424-9592012, details D and E) in a vertical position between the work platforms at elevations of 70 feet, 2-13/16 inches and 80 feet, 7-13/16 inches.

7.23.2.2.2 Install one guide carriage assembly (Drawing 424-9592015) on each of the two guide beam assemblies, using eight roller bearings for each guide carriage, as shown in Drawing 424-9592012.

The Stage II lower handling ring attaches by cables to the guide carriages.

7.23.2.2.3 Install, at an elevation of 91 feet, 2 inches, two brackets (Drawing 424-9592021) which are used to attach the lateral support cables for the upper handling ring for the Stage II, as shown in Drawing 424-9592012. This elevation is the lowest platform of the white room.

7.23.2.2.4 Install four brackets (Drawing 424-9592025), to which the lower wind support assembly (for Stage II) cables attach, to the inside of the white room walls, as shown in Drawing 424-9592012 at an elevation of 103 feet, 3-7/8 inches.

7.23.2.2.5 Attach four monorail track assemblies to the underside of the movable platform sections at an elevation of 80 feet, 8 inches as shown in Drawings 424-9592012 and 424-9592050-019.

These tracks are used to support the four hoist assemblies by which the lower handling ring halves may be lowered to the work platform at the 70-foot, 3-inch elevation after removal from the launch vehicle Stage II.

7.23.2.2.6 Attach four monorail track assemblies to the underside of the movable platform sections at the 91-foot, 2-inch elevation, as shown in Drawings 424-9592012 and 424-9592050-029.

These tracks are used to support the four hoist assemblies by which the upper handling ring halves may be lowered to the work platform at 80-foot, 8-inch elevation after removal from the launch vehicle Stage II.

7.23.2.2.7 Install the location plate (Drawing 424-9592018-003, Centerline Aft Wheel Transtainer, Stage II) on the transtainer track with the indicator arrow at an elevation of 73 feet, 8-7/8 inches as shown in Drawing 424-9592012.

7.23.2.2.8 Attach brackets to the hoist bridge beam, as noted in Drawing 424-9592012.

These brackets are used to attach safety cables to the lifting spider fitting (Drawing 424-9592017) to relieve the load on the crane brake during periods of sustained suspension of the load.

7.23.2.3 Stage II Stabilizing Line Installation, Stage II Erector

The installation of the columns, guide carriage assemblies, monorail track assemblies and various brackets which are secured to the Stage II erector for attaching the cables and slings used to stabilize and align the launch vehicle Stage II in the Stage II erector is shown in Drawing 424-9592013 (Fig. 7-70).

7.23.2.3.1 Weld the two guide beam assemblies (Drawing 424-9592023) in a vertical position between the work platforms at elevations of 8 feet, 5-1/8 inches and 20 feet, 5/16 inch.

7.23.2.3.2 Install one guide carriage assembly (Drawing 424-9592015) on each of the two guide beam assemblies, using eight roller bearings for each guide carriage, as shown in Drawing 424-9592013.

The aft handling ring (Drawing 804E102700-009) of Stage II attaches by cables to the guide carriages.

7.23.2.3.3 Install, at an elevation of 29 feet, 2-1/2 inches, the brackets (Drawing 424-9592029-001) to which the forward support cables for the forward handling ring are attached, as shown in Drawing 424-9592013.

7.23.2.3.4 Weld the four brackets (Drawing 424-9592027), to which the wind support assembly (Drawing 424-9592028) cables attach, to four vertical columns at the 42-foot elevation, as shown in Drawing 424-9592013.

7.23.2.3.5 Attach four monorail track assemblies to the undersides of the movable platform sections at elevations of 20 feet, 1/8 inch and 30 feet, 5-1/8 inches, as shown in Drawing 424-9592051.

These tracks support the four hoist assemblies by which the aft and forward handling ring halves may be lowered to the work platform at elevations of 8 feet, 5-1/8 inches and 20 feet, 1/8 inch, respectively, after removal from the launch vehicle Stage II.

7.23.2.3.6 Install the location plate (Drawing 424-9592018-003, Centerline Aft Wheel Transtainer Stage II) on the transtainer track with the indicator arrow at an elevation of 12 feet, 6-3/8 inches, as shown in Drawing 424-9592013.

7.23.3 Checkout Procedure

7.23.3.1 Stabilizing Line System Checkout Procedure

After completion of the installation of the Stabilizing Line System, checkout is performed in accordance with GSTP-424-1039/AMR (CVE) and GSTP 424-1040/AMR (Stage II).

7.23.3.1.1 Visually inspect all components of the Stabilizing Line System for compliance with engineering specifications.

7.23.3.1.2 Check the guide carriages for free movement on the guide beams.

7.23.3.1.3 Check all removable pins and clamping devices for freedom of installation.

7.23.4 Documentation

Document No.	Title
424-2053000	AGE Installations, Erector CVE
424-2153000	AGE Installations, Erector-Stage II
424-9592000	Stabilizing Lines, CVE and Stage II Erector
424-9592009	Operating Procedure, Stabilizing Line Installation
424-9592011	Stabilizing Line Installation, Stage I Erector Structure, Complete Launch Vehicle
424-9592012	Stabilizing Line Installation, Stage II, Complete Vehicle Erector
424-9592013	Stabilizing Line Installation, Stage II Erector Structure
424-9592015	Carriage Assembly, Guide
424-9592016	Details, Plate
424-9592017	Fitting, Cable, Lifting Spider, CVE
424-9592018	Details, Location Plate, Transtainer Wheel
424-9592021	Bracket Support, Cable, Launch Vehicle Stabilizing
424-9592021	Guide Beam, Assembly and Installation
424-9592025	Wind Load Bracket Assembly, Launch Vehicle Stabilizing

Document No.	Title
424-9592027	Details, Plate and Bracket Assemblies
424-9592028	Support, Wind Load Assembly
424-9592029	Bracket Support, Cable
424-9592050	Track Installation, CVE
424-9592051	Track Installation, Stage II Erector
GSTP-424-1039/AMR	Complete Vehicle Erector
GSTP-424-1040/AMR	Stage II Vehicle Erector

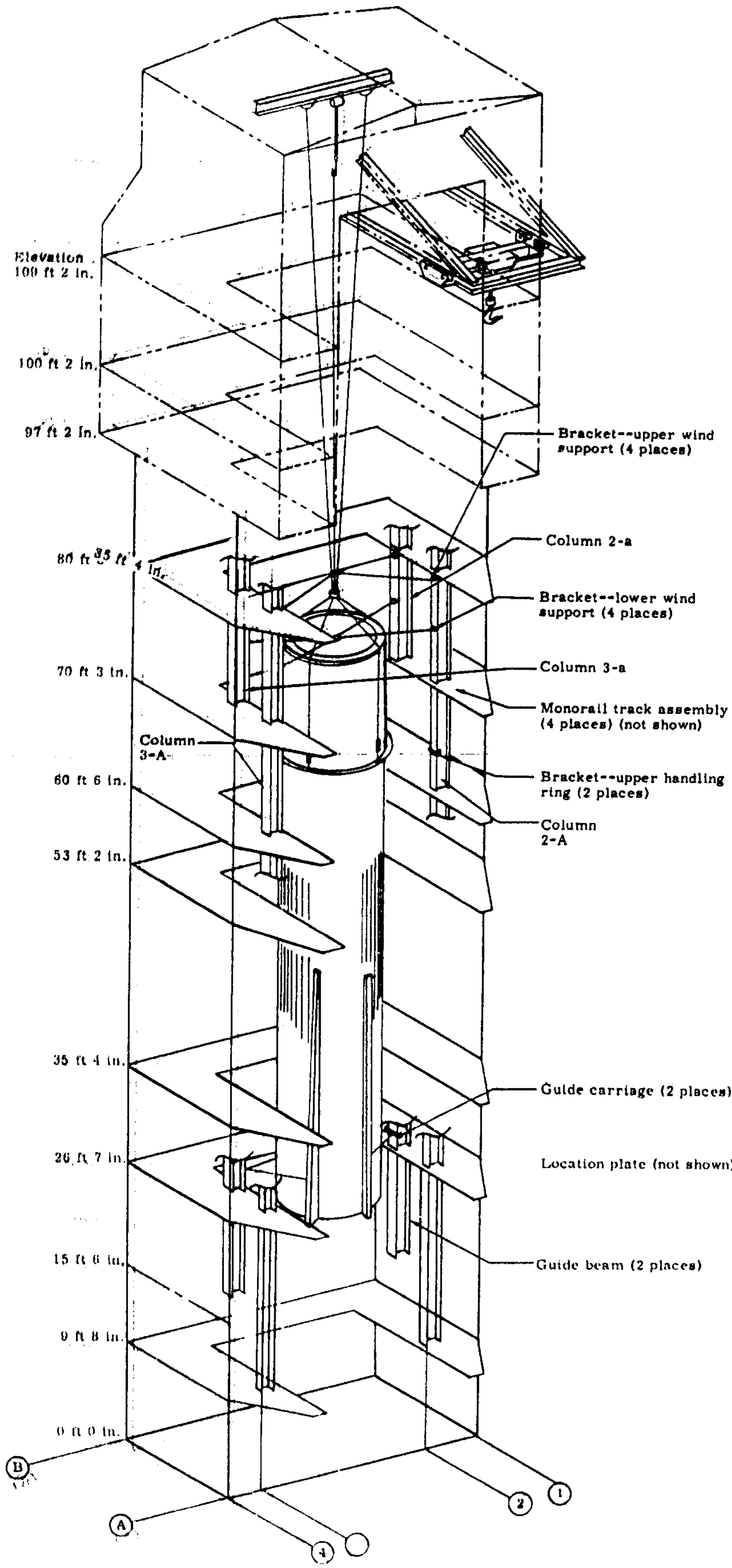


Fig. 7-68. Stabilizing Line System Installation--Complete Vehicle Erector, Launch Vehicle, Stage I

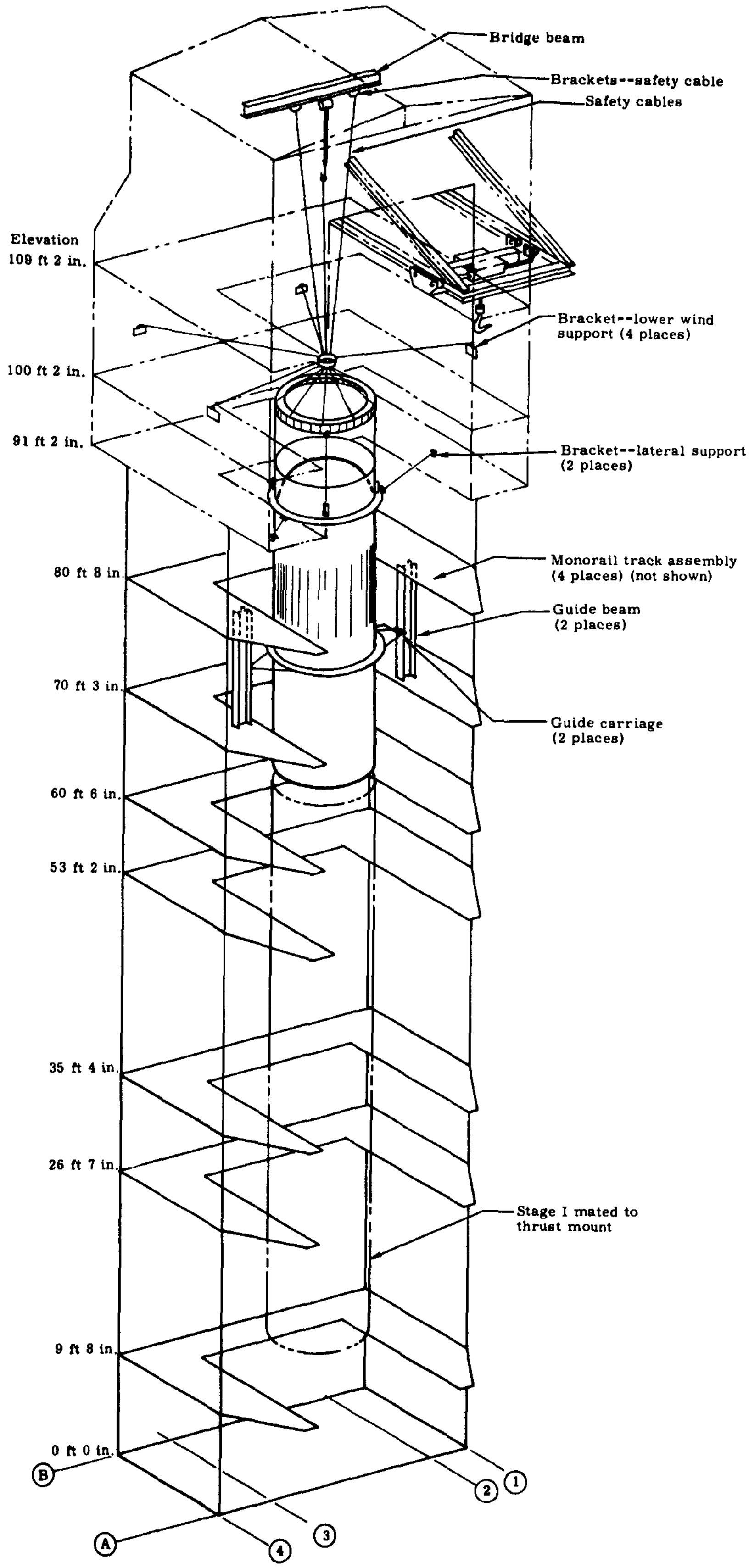


Fig. 7-69. Stabilizing Line System Installation--Stage I Erector, Launch Vehicle, Stage II

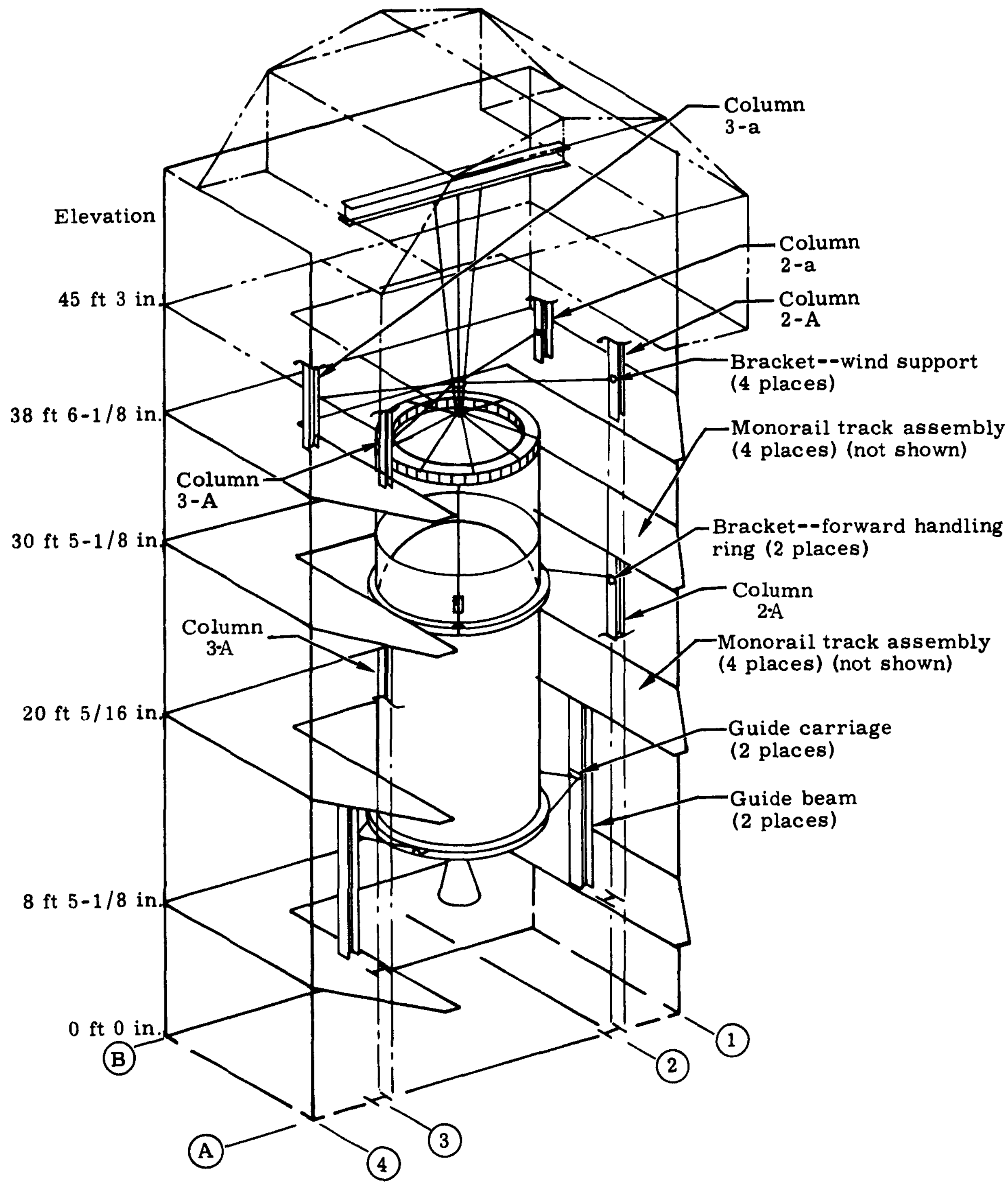


Fig. 7-70. Stabilizing Line System Installation--Stage II Erector

7.24 LAUNCH VEHICLE RELEASE CONTROL SET INSTALLATION

7.24.1 Description

The Launch Vehicle Release Control Set (LVRCS) performs the following functions: releases the spacecraft adapter section umbilical connector and the spacecraft upper umbilical connector, actuates the squibs for the drop weight disconnect system for the spacecraft upper umbilical line and provides signals for ignition of the launch vehicle hold-down explosive nuts. This set (Fig. 7-71) consists of the following:

(1) An LVRCS rack which will be located on the second floor of the approach ramp building.

(2) An LVRCS cable set.

(3) Eight explosive nut and gas pressure cartridges.

(4) An adapter section umbilical connector release.

(5) An upper umbilical connector release.

(6) A drop weight disconnect system.

(7) Launch release junction box (two used).

Items (4) and (5) shall be furnished by McDonnell.

7.24.2 Sequence of Events

7.24.2.1 LVRCS Installation

7.24.2.1.1 Install the LVRCS (424-477600-009) on the second floor of the approach ramp building in accordance with 424-215200, AGE Installations, Launch Deck, Lower Levels, Complex 19.

7.24.2.2 Launch Release Junction Box Installation

7.24.2.2.1 Install the launch release junction box (424-9501450-009) in the complete vehicle thrust ring area. The junction box shall be located and installed (two places) in accordance with 424-2052000, AGE Installation, Approach Ramp and Launch Deck, Complete.

7.24.2.3 Explosive Nuts Installation

7.24.2.3.1 The explosive nuts (PS 335200000-003) and gas pressure cartridges (PS 601100010-005) are installed during launch countdown. During the countdown, explosive nuts must be installed and electrically connected. Cabling is provided by 424-9501340.

7.24.2.4 LVRCS Cabling Installation

7.24.2.4.1 Install and connect the LVRCS cabling in accordance with 424-9501340, Cabling and Interconnections, Launch Vehicle Release Control Set, and 424-2050300, Cable Set Installation, AGE. Following installation, cabling should be checked to verify compliance with 424-9501001, AMR Cable Test Specification.

7.24.3 Checkout Procedure

7.24.3.1 LVRCS Checkout Procedure

Check out and verify system operation by performing the tests required by GSTP 424-1030/AMR, MOCS.

7.24.3.1.1 Provisions for the adapter section umbilical connector release and the upper umbilical connector release will be provided by McDonnell. Necessary cabling to the McDonnell interface is provided by 424-9501340.

7.24.4 Documentation

Document No.	Title
424-2152000	AGE Installations, Launch Deck, Lower Levels, Complex 19
424-4776000	Launch Vehicle Release Control Set
424-9501340	Cabling and Interconnections, Launch Vehicle Release Control Set
424-9820002	Drop Weight System, Spacecraft Umbilical
PS 335200000	Nut, Separation

Document No.	Title
PS 601100010	Cartridge, Gas Pressure
424-1430002	Gemini Launch Vehicle Checkout and Test Specification, AMR
424-1400000	Structural Assembly, Complete, AMR
424-2052000	AGE Installation, Approach Ramp and Launch Deck, Complete
424-2050300	Cable Set Installation, AGE
424-9501001	AMR Cable Test Specification

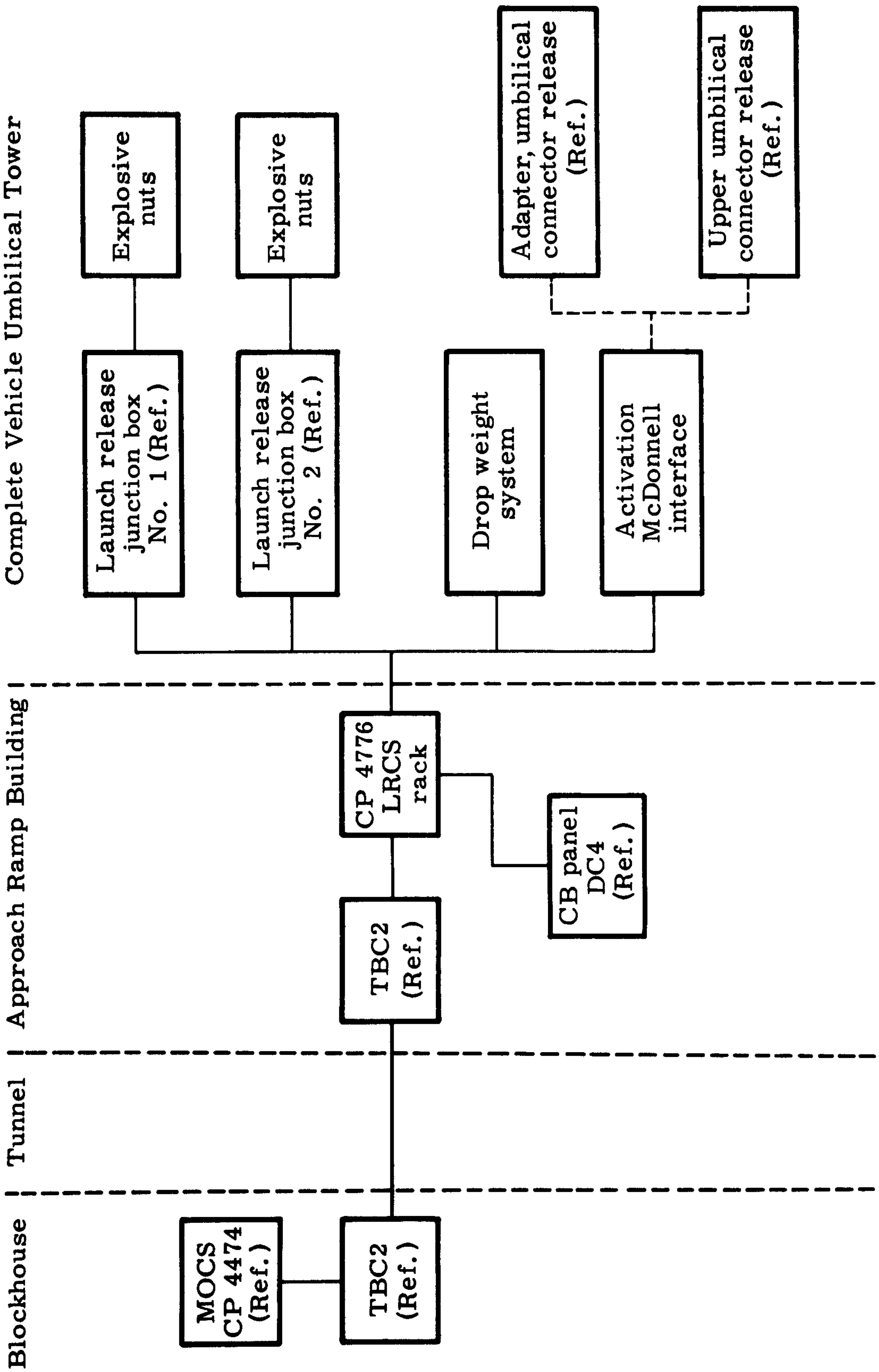


Fig. 7-71. Launch Release Control Set Cabling

7.25 ERECTOR CURTAIN INSTALLATION

7.25.1 Description

Stage I. Curtains (CP 9270, complete vehicle erector and CP 9180, Stage II erector) are installed to protect personnel working on the erector and the launch vehicle and/or equipment within the erector during inclement weather to ensure a continuance of normal activities.

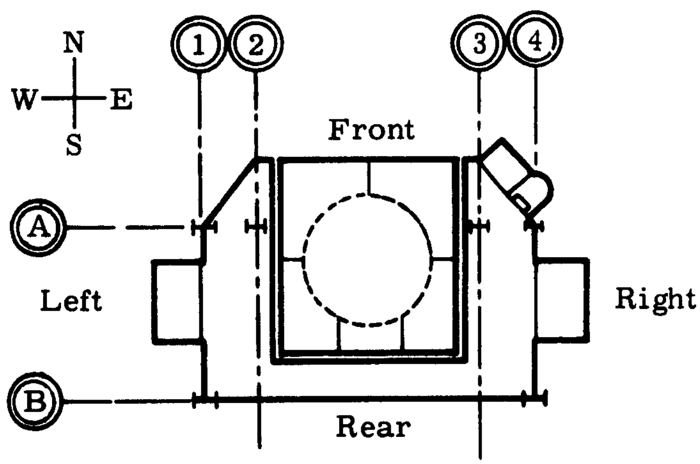
The curtains are designed so that they may be installed, operated, or stowed manually or with simple hand tools with a minimum of effort.

The configuration of the CVE curtains (Fig. 7-72) and their supporting hardware and the method of installation on the CVE is the same as for the Titan II curtains, except for modifications as noted in Design Criteria 424-1715020.

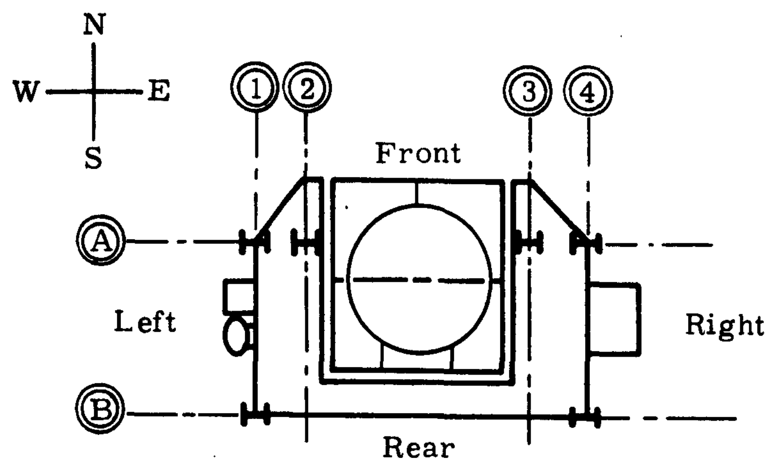
The configuration of the Stage II curtains (Fig. 7-73) and their supporting hardware is the same as for Titan II (804B9180014, unmodified).

All fabrication and installation of the erector curtains and their supporting hardware is done at AMR, Launch Complex 19. Curtain supporting hardware is installed after all structural modifications have been made to the CVE, including the installation of the second elevator which is located on the east face of the erector; the relocation of the ladder and landings to the northeast face; modifications as required by, and installation of, the white room facility; and installation of all piping, conduits, wiring and ducting.

The structural columns of the erectors are identified by notations, such as "Column 1-A," which utilize the coordinate system on the plan view of the following sketches.



Key Plan, Complete Vehicle Erector



Key Plan, Stage II Erector

In this section, all references to 804C92702l5 presume inclusion of such modifications as may be specified by Design Criteria 424-1715020, paragraph 3.3.1.

Utilize existing items (e.g., tracks, rollers, etc.) to the maximum extent with the least modifications consistent with the configuration requirements of the curtains.

The installation of curtain support hardware is described before the installation of the curtains themselves. The curtains are designed "on-site" to fit the "as-built" curtain support hardware.

7.25.2 Sequence of Events

7.25.2.1 Curtain Support Hardware Installation on the Complete Vehicle Erector

7.25.2.1.1 East and west faces. Install curtain support hardware on Column Rows 1 (west face) and 4 (east face) between the platforms and elevators. Installation on Column Row 4 is opposite of that on Column Row 1, except below the 9-foot, 8-inch elevation.

In general, the curtain installation on the east and west faces should permit easy access from the elevators to the work platforms at the 9-foot 8-inch, 35-foot 4-inch, 60-foot 6-inch, 70-foot 3-inch and 80-foot 8-inch elevations, while at the same time satisfying the requirements of ease of operation and adequate weather protection.

The description of installation presented in the following paragraphs applies to Column Row 1.

(1) Install a cable vertically from the deck up along Column 1-A to the 9-foot 8-inch elevation, then along the horizontal structural member, and then vertically down Column 1-B to the deck grating. Weld U-bolts to the top of the grating on the launch deck (804C9270215, sheet 5). The curtain attaches to this cable and to the U-bolts.

Omit this curtain support hardware on Column Row 4 (east face).

(2) Install a cable vertically along Columns 1-A and 1-B and horizontally along the horizontal structural member at the 15-foot 6-inch elevation as shown by 804C9270215, sheet 6. The curtain between the 9-foot 8-inch and 15-foot 6-inch elevations attaches to this cable at the top and sides and to the cable previously installed at the 9-foot 8-inch elevation.

(3) Install a cable support arrangement identical to that just described to support the curtains from an elevation of 15 feet 6 inches to an elevation of 26 feet 7 inches (804C9270215, sheet 6).

(4) Install cable supports, track hangers, tracks, etc., at an elevation of 35 feet 4 inches and attach U-bolts at an elevation of 26 feet 7 inches (804C9270215, sheet 20).

(5) Install track hangers, tracks, etc., at elevations of 35 feet 4 inches and 44 feet 3 inches (804C9270215, sheet 7). The curtain attaches to the curtain hooks with harness snaps.

(6) The installation made from the 44-foot 3-inch elevation to the 53-foot 3-inch elevation (804C9270215, sheet 9) is similar to the installation from 35 feet 4 inches to 44 feet 3 inches.

(7) Between the 53-foot 3-inch and 60-foot 6-inch elevations, the curtains are supported at the top by a track and attached to U-bolts at the bottom (804C9270215, sheet 10).

(8) The manner of curtain attachment between the 60-foot 6-inch and 70-foot 3-inch elevations, between the 70-foot 3-inch and 80-foot 8-inch elevations, and between the 80-foot 8-inch and 88-foot 9-inch elevations is by a track at the top and by U-bolts at the bottom. Details of these installations are presented in 804C9270215, sheets 12, 13 and 15.

7.25.2.1.2 North and south faces, launch deck shelter. Install the support hardware for the protective shelter located on the north face of the CVE below the 9-foot 8-inch elevation and all other curtains on the north and south faces below this elevation.

(1) Install curtain track hangers, tracks, cables, etc., along the northwest, north and northeast edges of the work platform at the 9-foot 8-inch elevation (804C9270215, sheets 3 and 4).

(2) Install three vertical pipe columns (Item 24, 804C9270215, sheet 5) on the launch deck.

(3) Attach a cable between the tops of the three columns.

(4) Attach a cable from the bottom to the top of the westernmost column, then to the north end of the work platform at an elevation of 9 feet 8 inches.

(5) Attach U-bolts to the launch deck grating along the horizontal projection of these two cables.

(6) Attach a cable from the bottom to the top of the easternmost column, then to the northeastern corner of the work platform at an elevation of 9 feet 8 inches.

(7) Attach U-bolts to the launch deck grating along the horizontal projection of this cable and the curtain track installed along the northeast edge of the work platform at an elevation of 9 feet 8 inches (804C9270215, sheets 4 and 5). The fabric panels of the shelter attach to the cables and U-bolts with harness snaps.

(8) Attach the curtain track for the panels along the south face below the 9-foot 8-inch elevation (804C9270215, sheets 4 and 5).

(9) Attach U-bolts to the launch deck on a line south of the erector pivots as shown by 804C9270215, sheet 5, Section D-D. The front (north) panel of the shelter attaches to the cable stretched between the three 8-foot columns on the launch deck, to the vertical cables attached to the two outside columns and to the U-bolts on the launch deck.

7.25.2.1.3 Install support hardware for fixed curtains around the ladder and landings which are located on the northeast face of the CVE from the 35-foot 4-inch to the 88-foot 9-inch elevation.

(1) Install vertical cables along Column 4-A and along the northernmost corner of the fixed work platform in line with Column Row 3 between elevations of 35 feet 4 inches and 88 feet 9 inches.

(2) Attach horizontal and/or vertical cables to the outboard edges of the ladder guard and landings to facilitate the most effective curtain installation. U-bolts along the ladder safety enclosure and along the edge of the landings are also used for the horizontal curtain edge attachments.

The curtain installations around the ladder and landings are fixed, and no provision is made for sliding openings. The top of this ladder enclosure is capped off with fabric for weather protection.

7.25.2.1.4 South face. Install support hardware along Column Row B (south face) of the CVE between the 9-foot 8-inch and 88-foot 9-inch elevations.

(1) Install track hangers, flashing and tracks along vertical and horizontal structural members between the 9-foot 8-inch and 15-foot 6-inch elevations and between the 15-foot 6-inch and 26-foot 7-inch elevations. The curtain is in three sections at each of these elevations (804C9270215, sheet 6).

(2) Install hangers, tracks, etc., at the 26-foot 7-inch and 35-foot 4-inch elevations (804C9270215, sheet 20). The curtain is in two sections at this elevation and may be extended by draw ropes.

(3) Install hangers, tracks, etc., from the 35-foot 4-inch to 44-foot 3-inch elevations (804C9270215, sheet 7). The curtain is in two sections at these elevations. This is typical of the hardware installations made at elevations of 44 feet 3 inches to 53 feet 3 inches, 53 feet 3 inches to 60 feet 6 inches, 60 feet 6 inches to 70 feet 3 inches, 70 feet 3 inches to 80 feet 8 inches and 80 feet 8 inches to 88 feet 9 inches. These installations are shown, respectively, by the following: 804C9270215, sheets 9, 10, 12, 13 and 15.

7.25.2.1.5 North face, east half. Install curtain support hardware on the north face of the CVE, from the centerline to Column Row 3 between elevations of 35 feet 4 inches and 88 feet 9 inches and from the centerline to Column 4-A, between elevations of 35 feet 4 inches and 9 feet 8 inches.

(1) Install curtain tracks, etc., on the top sides of brackets already installed at the 9-foot 8-inch elevation (804C9270215, sheet 3).

(2) Install track support brackets (with tracks above and below brackets), etc., at the 35-foot 4-inch elevation. Tracks are broken but continuous at the platform hinge centerline. One section of curtain extends from the 9-foot 8-inch to the 35-foot 4-inch elevation and from the centerline to Column 4-A.

(3) Install curtain support hardware (as installed between 9-foot 8-inch and 35-foot 4-inch elevations) at the 60-foot 6-inch, 70-foot 3-inch and 80-foot 8-inch elevations (804C9270215, sheet 11).

(4) Install the curtain support hardware between elevations of 80 feet 8 inches and 91 feet 2 inches (underside of the white room). At this elevation the curtain hangs vertically (Fig. 7-72) rather than at an angle to the vertical.

7.25.2.1.6 North face, west half. Install the curtain support hardware on the north face from the centerline to Column 1-A between the 9-foot 8-inch and 91-foot 2-inch elevations.

(1) Install track hangers, tracks, etc., at the 35-foot 4-inch elevation. The tracks are broken but continuous at the platform hinge centerline. Tracks are installed above and below these track hangers (804C9270215, sheet 8). The curtain at this elevation is attached to the already installed cables at the 9-foot 8-inch elevation (804C9270215, sheet 4).

(2) Using the same procedures, install curtain support hardware at the 60-foot 6-inch, 70-foot 3-inch and 80-foot 8-inch elevations (804C9270215, sheet 11).

(3) Install the curtain support hardware on the underside of the white room platform at the 91-foot 2-inch elevation. The track hangers are attached in a downward vertical position.

7.25.2.2 Curtain Support Hardware Installation on the Stage II Erector

7.25.2.2.1 Install curtain support hardware on all sides of the erector at and below the 8-foot 5-1/8-inch elevation.

(1) Install a cable from the bottom of Column 4-A vertically along Column 4-A, to the 8-foot 5-1/8-inch elevation, then along the horizontal structural member to Column 4-B, then vertically down to the bottom of Column 4-B (804B9180014, sheet 3).

(2) Install four cables, one along each of Columns 1-A, 1-B, 11-B, 4-A and 9-B, from the bottom of each column to the 8-foot 5-1/8-inch elevation (804B9180014, sheet 3).

(3) Weld curtain track hangers along the horizontal member at the 8-foot 5-1/2-inch elevation on the south face (804B9180014, sheet 5). Install tracks above and below these hangers (804B9180014, sheet 11, Detail H). Install trolleys, curtain hooks, etc., as shown by 804B9180014, sheet 12, which also shows the manner of curtain attachment. The curtain is in two sections at this location.

(4) Install track hangers along the northeast and northwest edges of the work platform at the 8-foot 5-1/8-inch elevation (804B9180014, sheets 5 and 11, Detail G-G).

(5) Install track hangers along the edge of the north section of the work platform at this elevation. The north section of the platform is attached to the thrust mount (804B9182052-009).

(6) Install the tracks along the northeast, north and northwest edges above and below the track hangers (804B9180014, sheet 11). The tracks are broken where the fixed platform of the thrust mount meets the erector platform, but the track sections are colinear (804B9180014, sheets 5 and 11, Details M-M and N-N).

(a) Install trolleys, curtain hooks, etc., as shown by 804B9180014, sheet 13, which also shows the manner of curtain attachment. These track sections support the curtains above and below the 8-foot 5-1/8-inch elevation on the northeast, north and northwest faces.

(7) Weld brackets and attach eye bolts along the horizontal member and on the kick plate of the east face at the 8-foot 5-1/8-inch elevation (804B9180014, sheet 5). The bottom edge of the curtain above this elevation attaches to these eye bolts.

(8) Install the track hangers and other hardware along the horizontal member on the west face at 8-foot 5-1/8-inch elevation (804B9180014, sheet 5). Install track on only the top of these hangers (804B9180014, sheet 11, Detail J) extending from Column 1-A south to the north edge of the ladder landing. No curtain exists on the west face of the erector below the 8-foot 5-1/8-inch elevation.

(9) Install three vertical pipe columns on the launch deck, on an east-west line, north of the erector.

(10) Attach a cable from the launch deck, vertically along the easternmost column to the top, horizontally to the top of the westernmost column, then vertically downward to the launch deck (804B9180014, sheet 12).

(11) Install pipe braces from the tops of the two outer pipe columns on the launch deck back to Columns 1-A and 4-A at the 8-foot 5-1/8-inch elevation. These pipe braces and the cable support the top and side panels of the north face shelter below and 8-foot 5-1/8-inch elevation.

(12) Weld U-bolts to the deck grating along the horizontal projections of the pipe braces and the cable stretched between the tops of the three pipe columns.

(13) Weld U-bolts to the deck grating along the east, west and south sides. The bottoms of the curtains below the 8-foot 5-1/8-inch elevation are attached to these U-bolts. The complete north face shelter assembly is shown in 327-3038000.

7.25.2.2.2 Install three vertical cables on the west face of the erector to provide side supports for the curtains around the ladder and the ladder landings (804B9180014, sheet 4).

(1) Attach one cable vertically from the diagonal brace below the 8-foot 5-1/8-inch elevation to the horizontal member at the 52-foot elevation.

(2) Attach one cable from the horizontal member at the 30-foot 5-1/8-inch elevation to the horizontal member at the 45-foot 3-inch elevation.

(3) Attach one cable from the horizontal member at the 8-foot 5-1/8-inch elevation, running along the outboard side of Column 1-B, to a point on this column above the 30-foot 5-1/8-inch elevation.

7.25.2.2.3 Install curtain support hardware on all sides of the erector at the 20-foot 1/8-inch elevation (804B9180014, sheet 6).

(1) Install the track hangers along the northeast, north and northwest faces of the erector at this elevation (804B9180014, sheet 11). The track is broken along the platform north-south centerline where the two sections of curtain terminate. The track is also broken, but the sections are colinear at each platform hinge centerline. The curtains are continuous at these breaks.

(2) Install the tracks, etc., on these track hangers (804B9180014, sheet 13). These four track sections support the curtains above and below the 20-foot 1/8-inch elevation on the northeast, north and northwest faces.

(3) Install the track hangers along the east face at the 18-foot 8-1/4-inch elevation to the horizontal member at the 20-foot 1/8-inch elevation (804B9180014, sheet 6).

(4) Install track, trolleys, curtain hooks, rope guides and draw ropes (804B9180014, sheets 11 and 12) on the underside of these hangers. This track supports the curtain from the 18-foot 8-1/4-inch to 8-foot 5-inch elevations. The curtains are in two sections at this location.

(5) Weld brackets and attach eye bolts along the horizontal member and on the kick plate on the east face at an elevation of 20 feet 1/8 inch (804B9180014, sheet 6). The bottom edge of the curtain above this elevation attaches to these eye bolts.

(6) Weld track hangers along the horizontal member at the 20-foot 1/8-inch elevation extending from Columns 1-B to 4-B (south face), as shown by 804B9180014, sheet 6.

(a) Install tracks above and below these brackets. The tracks are broken at two places to permit operation of the erector actuators.

(b) Install trolleys, curtain hooks, rope guides and draw ropes (804B9180014, sheet 12). These tracks support the curtains above and below this elevation. The curtains between the 20-foot 1/8-inch and 8-foot 5-1/8-inch elevations are in three sections. The two outside sections are movable, by ropes, while the section between the erector actuators is fixed.

(7) Install the track hangers along the west face at an elevation of 20 feet 1/8 inch (804B9180014, sheet 6). Install tracks above and below these brackets. Tracks extend from Column 1-A to the first vertical cable on the west side of the erector.

(a) Install trolleys, curtain hooks, rope guides and draw ropes (804B9180014, sheets 11 and 12). These tracks support the curtains above and below the 20-foot 1/8-inch elevation. The curtain at this elevation is in a single section.

The curtain around the ladder and landings between the 8-foot 5-1/8-inch and 30-foot 5-1/8-inch elevations is fixed and of one piece, attached to the vertical cable near the center of the west erector face and stretched to the vertical cable along Column 1-B.

7.25.2.2.4 Install curtain support hardware on all sides of the erector at the 30-foot 5-1/8-inch elevation (804B9180014, sheet 7).

(1) Install support hardware at this elevation exactly as described for the 20-foot 1/8-inch elevation for all faces of the erector except the south face. At the 30-foot 5-1/8-inch elevation, the track on the south face is in one piece.

7.25.2.2.5 Install curtain support hardware on all sides of the erector at the 38-foot 6-1/8-inch elevation (804B9180014, sheet 8).

(1) Install support hardware on the east and south faces at this elevation exactly as at the 30-foot 5-1/8-inch elevation.

(2) Install support hardware on the northeast, north and northwest faces at this elevation exactly as at the 20-foot 1/8-inch elevation except that at this elevation only one track is used on the' hangers on these faces. This track is mounted below the hangers (804B9180014, sheet 11). The track supports the curtain below the 38-foot 6-1/8-inch elevation which is in two sections. This curtain hangs vertically rather than at an angle to the vertical.

(3) Install the support hardware along the west face at the 38-foot 6-1/8-inch elevation to the edge of the ladder landing exactly as at the 20-foot 1/8-inch elevation.

The curtain around the ladder and landing is stretched from one vertical cable, which is adjacent to the landing, to the other vertical cable which is adjacent to the ladder.

(4) Install the support hardware from the ladder to Column 1-B at an elevation of 38 feet 6-1/8 inches (804B9180014, sheet 8).

7.25.2.2.6 Install all curtain support hardware on all sides of the erector at the 45-foot 3-inch elevation (804B-9180014, sheet 9).

(1) Install the track hangers along the east face at the 44-foot 7-inch elevation as shown by 804B9180014, sheet 9.

(a) Install the track on only the underside of the hangers at this location (804B9180014, sheet 11).

(2) Install the track hangers on the west face along the horizontal member at the 45-foot 3-inch elevation from Column 1-A to the ladder landing and from the ladder to Column 1-B.

(a) Install tracks on only the underside of the hangers at these locations (804B9180014, sheet 9).

The curtain around the ladder and landing hangs vertically, stretched between the two vertical cables at the side of the landing and at the side of the ladder.

(3) Install track hangers (804B9180014, sheet 9) along the northeast and northwest faces at the 45-foot 3-inch elevation.

(a) Install tracks on only the underside of the brackets at these locations.

(4) Install all support hardware on these tracks. Roll-type drop curtains are used at these two locations.

There is no hardware installation along the north face at this elevation.

7.25.2.2.7 Install curtain support hardware on all sides of the erector at the 52-foot elevation (804B9180014, sheet 10).

(1) Install track hangers and other support hardware (804B9180014, sheets 11 and 12). The track is continuous and in one piece at this location, and the curtain is in two pieces.

(2) Install one cable along the north face, between Column Rows 2 and 3.

(3) Install one cable along the south face, between Column Rows 2 and 3.

7.25.2.3 Curtain Installation onto Support Hardware, Stage-II Erector

7.25.2.3.1 Install curtains onto the support hardware according to drawing 804B9180014, sheets 12 and 13.

Curtains are attached to the structural members of the erector by ropes at the following locations: on the east face between the 45-foot 3-inch and 52-foot elevations; on the west face between the same elevations (including the top covering of the enclosure about the ladder and landings) and on the northeast and northwest faces from the 52-foot elevation down to the roll-type curtains at the 45-foot 3-inch elevation. On the north face at the 52-foot elevation, a roll-type drop curtain attaches to the cable which runs along the north face horizontal member, between Column Rows 2 and 3. The bottom edge of this curtain ties to the handrail at an elevation of 38 feet 6-1/8 inches. The roof curtain panels are attached to the horizontal cables at the 52-foot elevation and are also tied to the structural members of the erector.

7.25.2.4 Curtain Installation onto Support Hardware, Complete Vehicle Erector

7.25.2.4.1 Install curtains onto the support hardware.

7.25.3 Checkout Procedure

7.25.3.1 Functional Test

The checkout procedure is the same for both the CVE and the Stage II erector.

7.25.3.1.1 Run operating equipment through several operating cycles to ensure that components function properly without interference.

7.25.3.1.2 Visually check curtains for holes, tears, etc., that would impair the function of the curtains.

7.25.4 Documentation

Document No.	Title
327-3038000	Inclement Weather Protection
327-3038010	Shelter--Installation
424-1715020	Design Criteria, Curtains, Erector
804B9180014	Curtain Assembly--Weather, Erector, Stage II
804C9270215	Weather Protection Assembly--Erector Structure, Complete Vehicle
PD60S0134	Curtains--Weather Protection, Erector

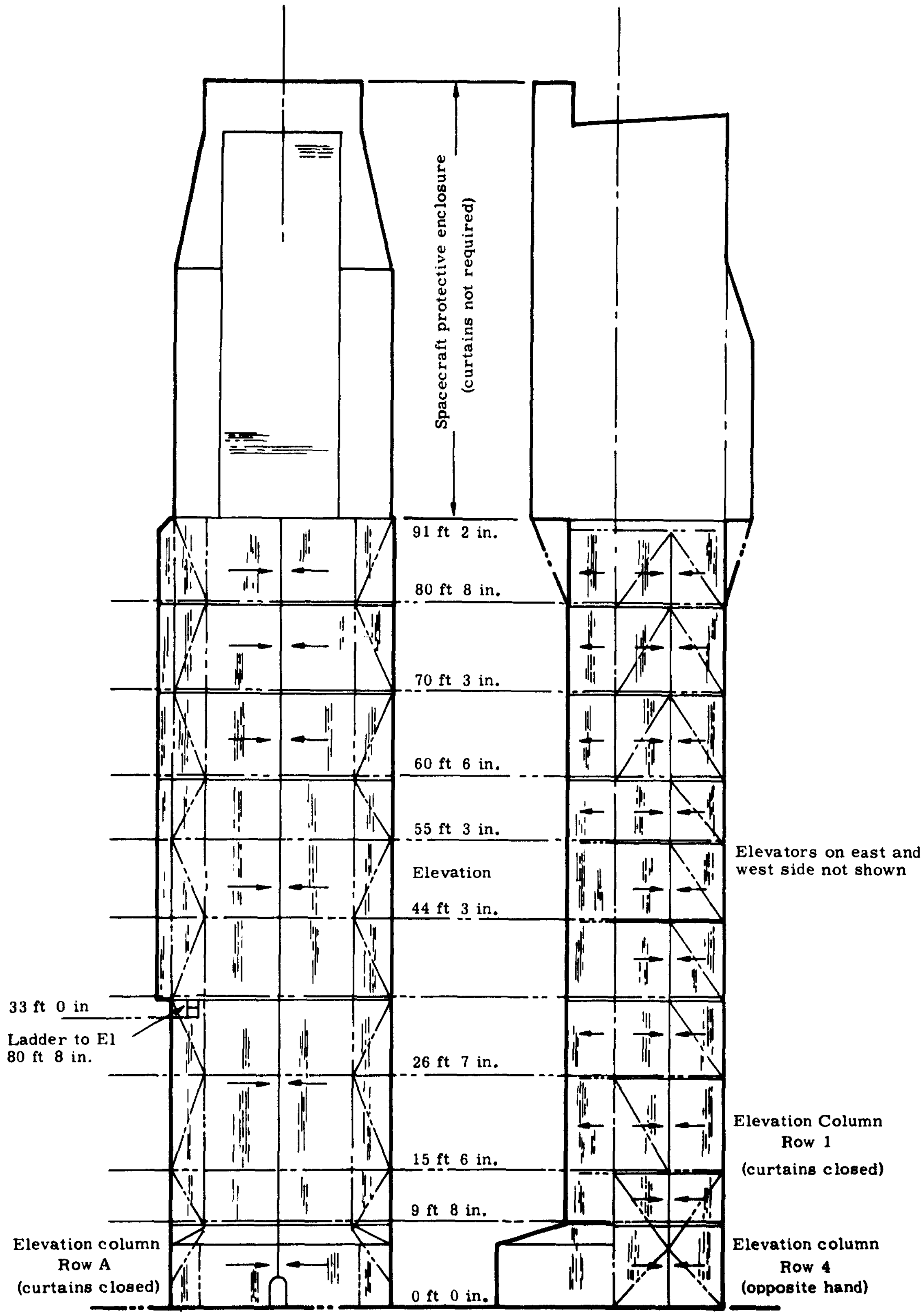


Fig. 7-72. Curtain Installation, Complete Vehicle Erector

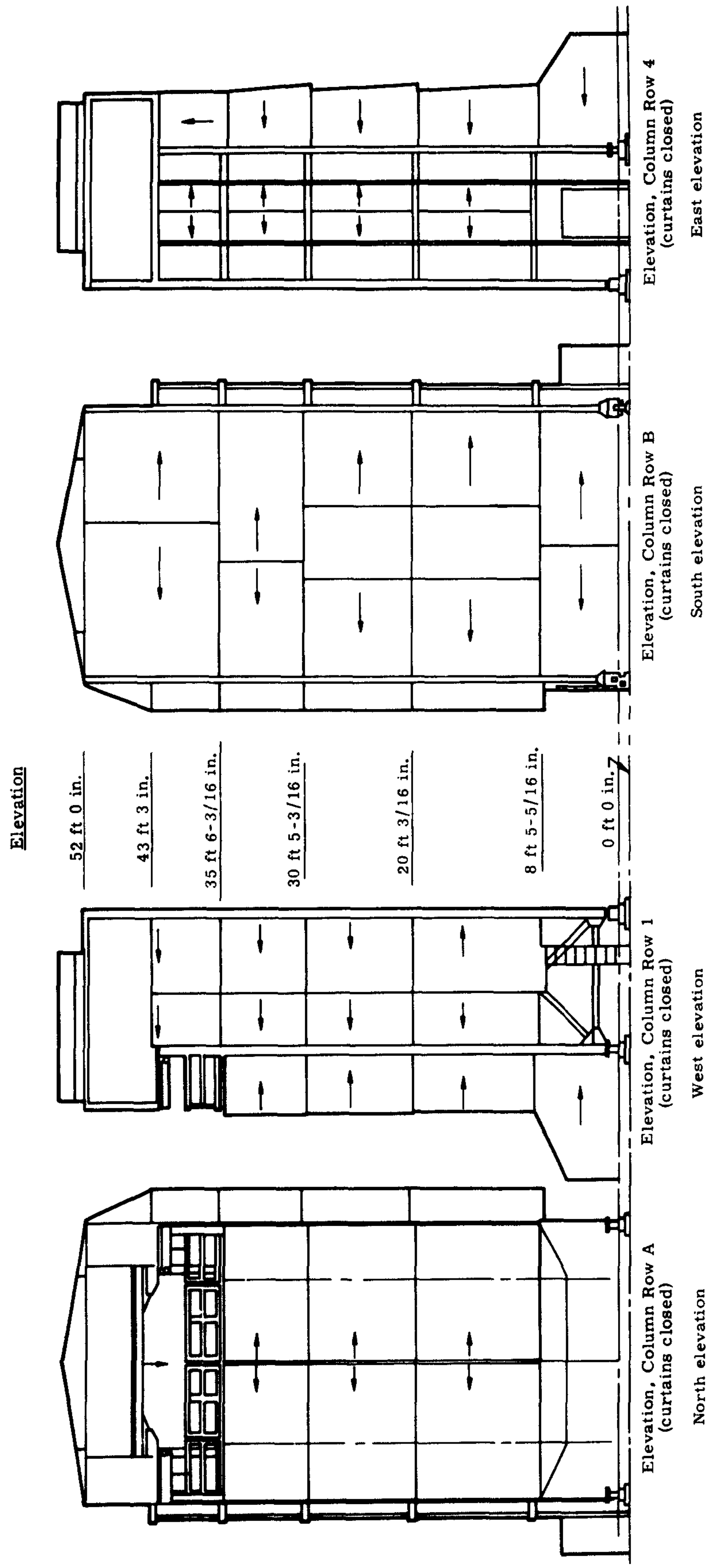


Fig. 7-73. Stage II Erector Curtains

7.26 SAFETY NETS INSTALLATION

7.26.1 Description

At various times during the program, the erectors are in the vertical position and the launch vehicle stages are not in place on the thrust mounts. In this condition, openings exist in the erector platforms with a diameter of approximately 11 feet 6 inches.

To prevent personnel from being injured by stepping or falling into the openings or being struck by objects falling from overhead, erector safety nets are provided across each erector platform opening.

Each safety net is constructed of 1-inch nylon webbing sewed together on approximately 6-inch centers in both directions.

Each safety net is shaped to fit the opening of the platform and has attaching hardware to fit eyebolts mounted on the platforms.

After installation, each safety net must be capable of withstanding 200 pounds falling a distance of 5 feet.

7.26.2 Sequence of Events

7.26.2.1 Platform No. 1 Installation, 35-foot 4-3/16-Inch Elevation (Fig. 7-74, Detail A)

7.26.2.1.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.1.2 Insert and fasten eyebolts in place (424-9176003-001).

7.26.2.1.3 Install safety net (424-9176001-09) by inserting fittings of safety net into eyebolts. Safety lock each fitting.

7.26.2.2 Platform No. 2 Installation, 60-Foot 6-Inch Elevation (Fig. 7-74, Detail B)

7.26.2.2.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.2.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.2.3 Install safety net (424-9176001-009) by inserting fittings on safety net into eyebolts. Safety lock each fitting.

7.26.2.3 Platform No. 3 Installation, 70-Foot 3-Inch Elevation (Fig. 7-75, Detail C)

7.26.2.3.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.3.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.3.3 Install safety net (424-9176001-009) by inserting fittings of safety net into eyebolts. Safety lock each fitting.

7.26.2.4 Platform No. 4 Installation, 80-Foot 8-Inch Elevation (Fig. 7-75, Detail D)

7.26.2.4.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.4.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.4.3 Install safety net (424-9176001-009) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.5 Platform No. 5 Installation, 91-Foot 2-Inch Elevation (Fig. 7-74, Detail E)

7.26.2.5.1 Field drill 30 mounting holes in kick plate.

7.26.2.5.2 Mount and attach eyebolts in place (424-9176003-001).

7.26.2.5.3 Install safety net (424-9176001-009) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.6 Platform No. 6 Installation, 100-Foot 2-Inch Elevation (Fig. 7-75, Detail F)

7.26.2.6.1 Mount and fasten 30 eyebolts in place (424-9176003-001).

7.26.2.6.2 Install safety net (424-9176001-009) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.7 Platform No. 7 Installation, 109-Foot 2-Inch Elevation (Fig. 7-75, Detail G)

7.26.2.7.1 Mount and fasten 30 eyebolts in place (424-9176003-001).

7.26.2.7.2 Install safety net (424-9176-019) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.8 Platform No. 8 Installation, 20-Foot 5/16-Inch Elevation (Fig. 7-75, Detail C)

7.26.2.8.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.8.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.8.3 Install safety net (424-9176001-009) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.9 Platform No. 9 Installation, 30-Foot 5-5/16-Inch Elevation (Fig. 7-75, Detail H)

7.26.2.9.1 Field drill 30 eyebolt mounting holes in kick plate.

7.26.2.9.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.9.3 Install safety net (424-9176001-009) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.10 Platform No. 10 Installation, 38-Foot 6-5/16-Inch Elevation (Fig. 7-74, Detail I)

7.26.2.10.1 Field drill 30 eyebolt mounting holes into end of platform sections.

7.26.2.10.2 Mount and fasten eyebolts in place (424-9176003-001).

7.26.2.10.3 Install safety net (424-9176001-019) by inserting safety net fittings into eyebolts; safety lock each fitting.

7.26.2.11 Removal and Storage of Nets

7.26.2.11.1 Remove each net after its installation and checkout and store in the stowage bag (424-9176002). Ten storage bags are furnished, one for each net.

7.26.3 Checkout Procedure

7.26.3.1 Visual Inspection

7.26.3.1.1 Visually inspect nets and support hardware to verify proper installation.

7.26.3.2 Functional Test

7.26.3.2.1 Check to verify that each net will support the design load.

7.26.4 Documentation

Document No.	Title
424-9176000	Personnel Safety Net Installation--Complete Vehicle and Stage II Erectors
424-9176001	Personnel Safety Net--Complete Vehicle and Stage II Erectors
424-9176002	Bag Stowage--Personnel Safety Net, Complete Vehicle Erector and Stage II Erector

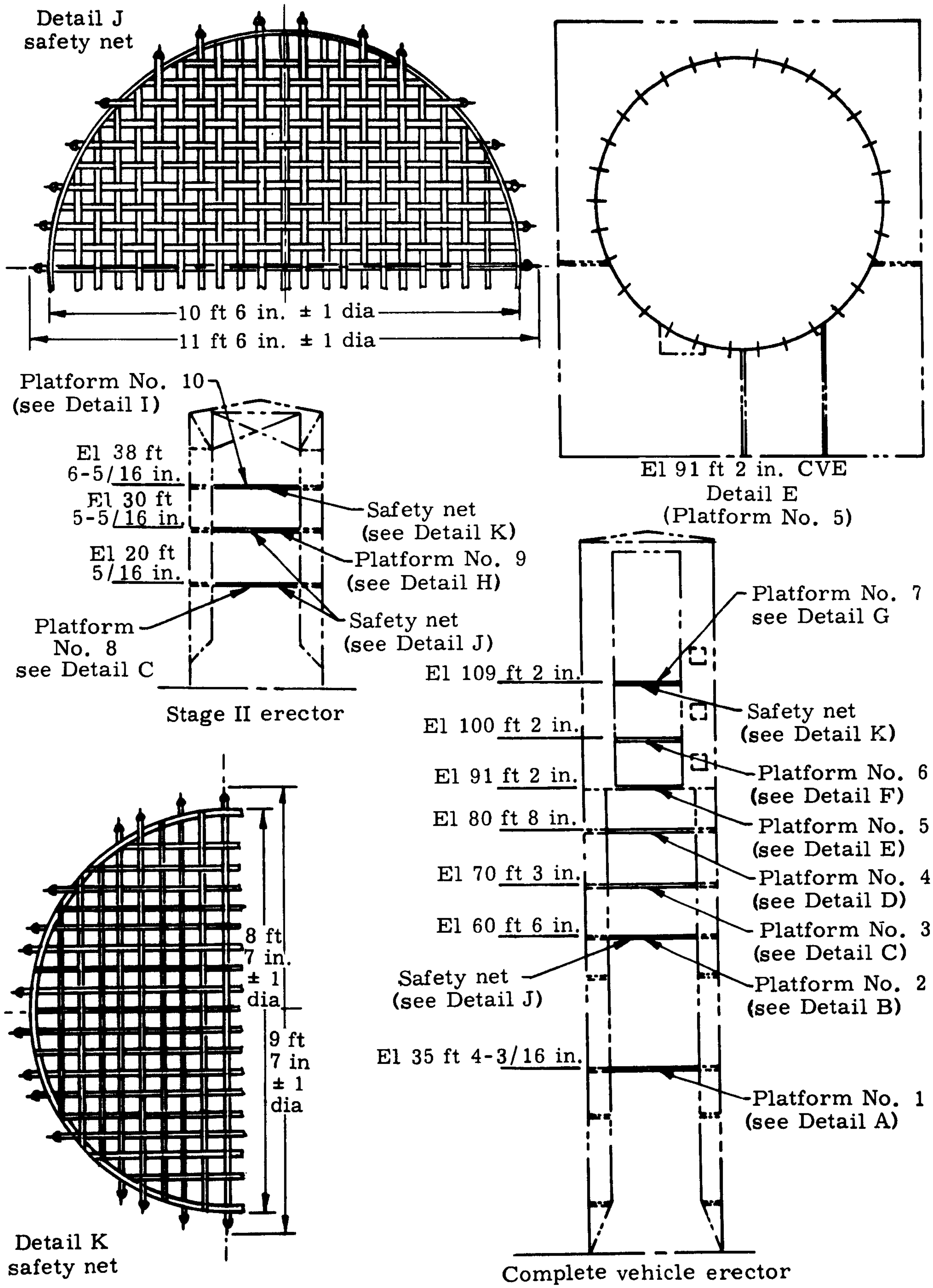


Fig. 7-74. Stage II Erector and Complete Vehicle Erector Safety Nets

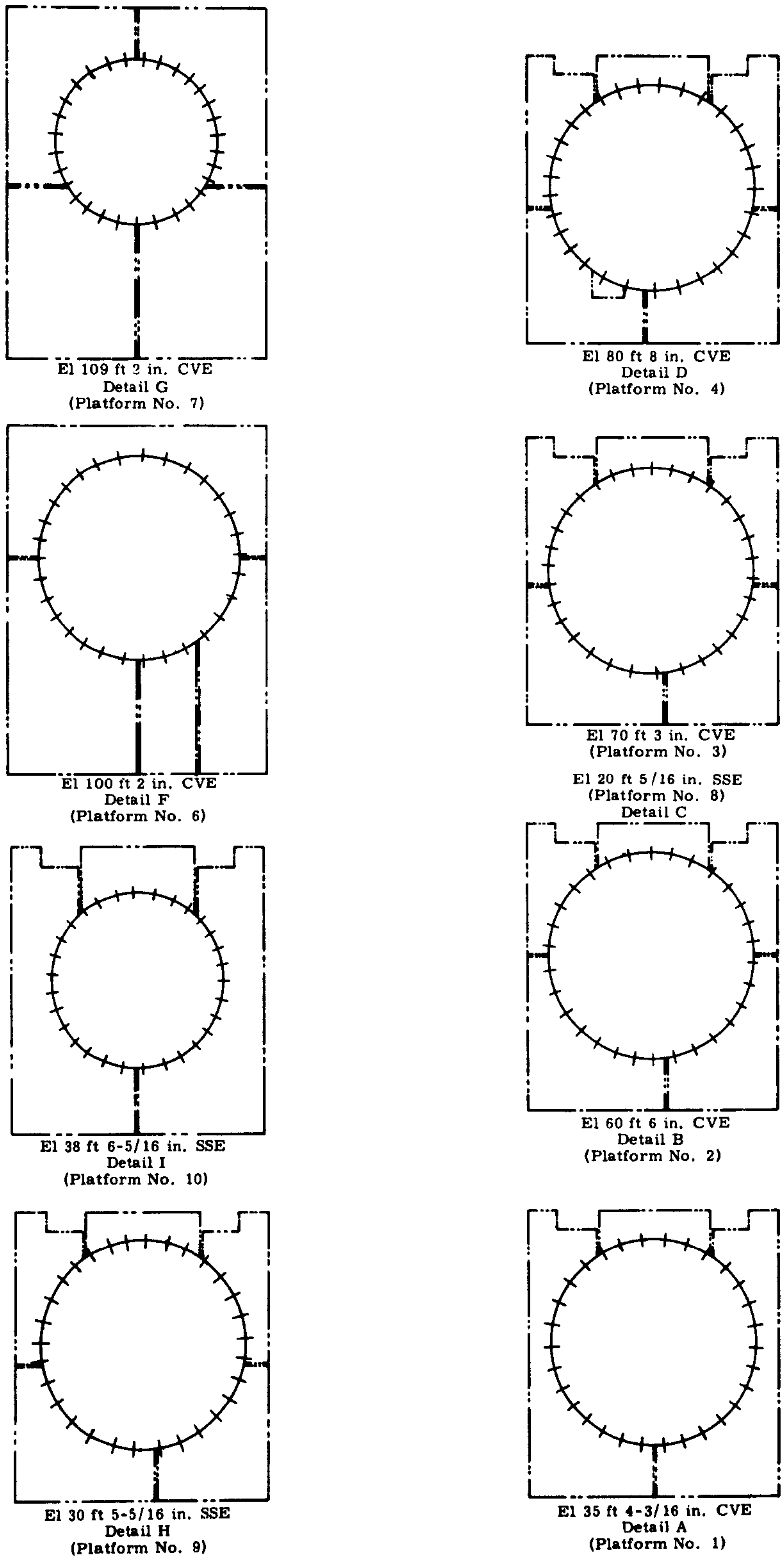


Fig. 7-75. Platforms 1, 2, 3, 4 and 6 Through 10

7.27 STATIC GROUNDING SYSTEM INSTALLATION

7.27.1 Description

To eliminate harmful ground loops and to minimize interference, a modified single-point grounding system will be provided for the equipment installed in the blockhouse and the approach ramp building areas (Fig. 7-76). Earth grounding grids, provided by the Army Corps of Engineers, will serve as the ground point. Tied into these "mats" will be two static ground distribution systems, the blockhouse grounding installation and the approach ramp building grounding installation. The grounding distribution systems will be connected by ground wires or straps to the various AGE racks and consoles. The system will consist of the following.

(1) Blockhouse electrical grounding system installation.

(2) Approach ramp building electrical grounding system installation.

(3) Complex 19 facility earth grounding grids.*

7.27.2 Sequence of Events

7.27.2.1 Electrical Grounding System Installation (Blockhouse)

7.27.2.1.1 Install the electrical grounding system in the blockhouse in accordance with 424-2051350 and National Electric Code (NEC), 1959.

7.27.2.2 Electrical Grounding System Installation (Approach Ramp Building)

7.27.2.2.1 Install the electrical grounding system in the approach ramp building in accordance with 424-2152350 and NEC, 1959.

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*Earth grounding grids will be provided by the Corps of Engineers. For details relative to ground grids and Complex 19 grounding system, refer to pages 81 through 84 of "Corps of Engineers Modification to Launch Complex 19."

7.27.3 Checkout Procedure

7.27.3.1 Checkout Objectives

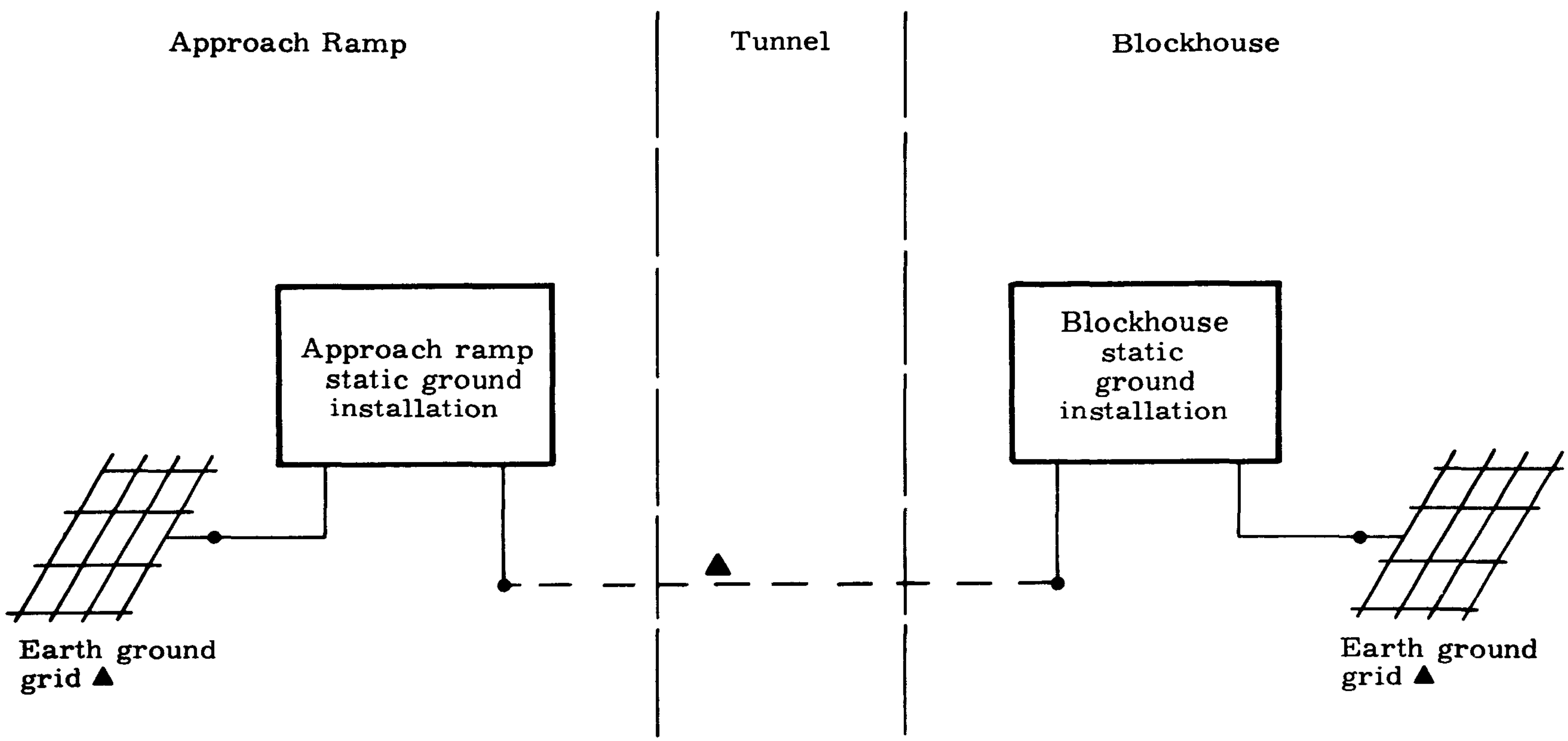
7.27.3.1.1 Conduct tests on the static grounding system to assure compliance with Electrical Grounding System Design Criteria, 424-9000201.

7.27.3.1.2 Following checkout, connect grounding distribution systems to their respective earth grounding grids* and to the grounding cables in the tunnel cableway.

7.27.4 Documentation

Document No.	Title
424-2051350	Electrical Grounding System Installation, Block-house--Complex 19
424-2152350	Electrical Grounding System Installation, Approach Ramp Building--Complex 19
424-9000201	Design Criteria, Electrical Grounding System
NEC, 1959	National Electric Code, 1959 Edition (National Board of Fire Underwriters Standard NBFU No. 70)
Army Corps of Engineers, File No. 70	Army Corps of Engineers, Modifications to Launch Complex 19

*Earth grounding grids will be provided by the Corps of Engineers. For details relative to ground grids and Complex 19 grounding system, refer to pages 81 through 84 of "Corps of Engineers Modification to Launch Complex 19."



▲ Earth ground grids and ground cable in tunnel trays will be provided by Corps of Engineers.

Fig. 7-76. AGE Static Ground System

7.28 FLIGHT CONTROL SYSTEM TEST SET INSTALLATION (CP 2600)

7.28.1 Description

The Flight Control System Test Set (FCSTS) performs various tests and provides a monitoring and control capability to the Flight Control System (FCS) during flight control functional verification, combined system acceptance test, sequential compatibility firing, flight readiness firing, and countdown prior to launch. The FCST consists of the following items:

(1) FCS console (CP 2610) at Locations 208, 209 and 210 on the second floor of the blockhouse.

(2) FCS checkout rack (CP 2620) at Location 206 on the first floor of the equipment room.

(3) FCS cables.

7.28.2 Sequence of Events

7.28.2.1 FCSTS Installation

7.28.2.1.1 Install the FCS console (CP 2610) on the second floor of the blockhouse.

The unit shall be located and installed in accordance with Drawing 424-2251000, AGE Installations, Blockhouse Second Floor, Complex 19.

7.28.2.2 FCS Checkout Rack Installation

7.28.2.2.1 Install the FCS checkout rack (CP 2620) in the transfer room on the first floor of the approach ramp building.

The unit shall be located and installed in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.28.2.3 FCSTS Cable Installation

7.28.2.3.1 Install the cables (Fig. 7-77) for the FCSTS in accordance with Drawings 424-9501051, Block Cordage, Flight Control System Test Set; 424-7501461, Block Cordage, Umbilical Cables; 424-9501002, AMR Cable Installation Requirements and 424-2050300, Cable Set Installation, AGE. The cables are installed in existing tunnel cable trays and the blockhouse and transfer room floor cable area.

The cables are installed between the equipment shown in Fig. 7-77.

The cable set transition rack PPZA (part of CP 9501) contains a patchboard that permits testing on either the complete launch vehicle or on the Stage II launch vehicle mounted on the Stage II thrust mount. The patchboard must be positioned manually to conform with the test setup. The cables must be checked out in accordance with AMR Cables Test Specification 424-9501001 prior to conducting functional tests.

7.28.3 Checkout Procedures

Conduct tests on the FCSTS in accordance with Drawing 424-1025/AMR, Ground System Test Procedure, Launch Vehicle Control.

7.28.3.1 Test Objectives

7.28.3.1.1 Verify the availability of correct input signals to the launch vehicle.

7.28.3.1.2 Verify that all measuring and recording devices internal to the FCSTS have the accuracies required.

7.28.3.1.3 Verify the correct transmission of "hold" and "kill" signals to the MOCS.

7.28.3.1.4 Demonstrate the supplementary test capabilities of the FCSTS.

7.28.3.1.5 Verify the proper operation of all monitoring devices within the FCSTS.

7.28.4 Documentation

Document No.	Title
424-2050300	Cable Set Installation, AGE
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2251000	AGE Installation, Blockhouse Second Floor, Complex 19

Document No.	Title
424-2600000	Flight Control System Test Set
424-9501001	AMR Cables Test Specification
424-9501051	Block Cordage, Flight Control System Test Set
424-9501002	AMR Cable Installation Requirements
424-9501461	Block Cordage, Umbilical Cables
424-975/AMR	Test Procedure, Flight Control System Functional Verification
424-1025/AMR	Ground System Test Procedure, Launch Vehicle Control

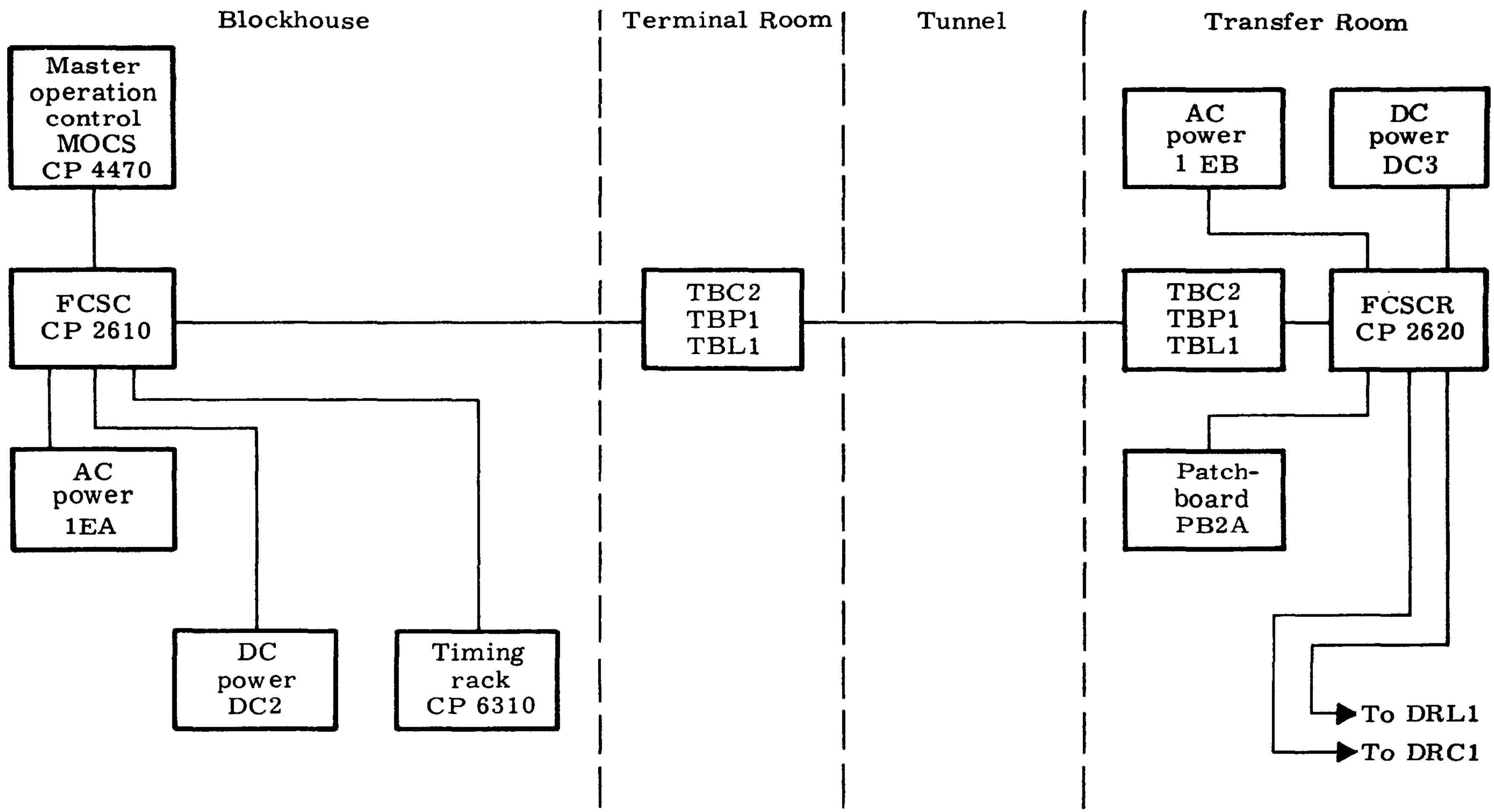


Fig. 7-77. Flight Control System Test Set Cabling

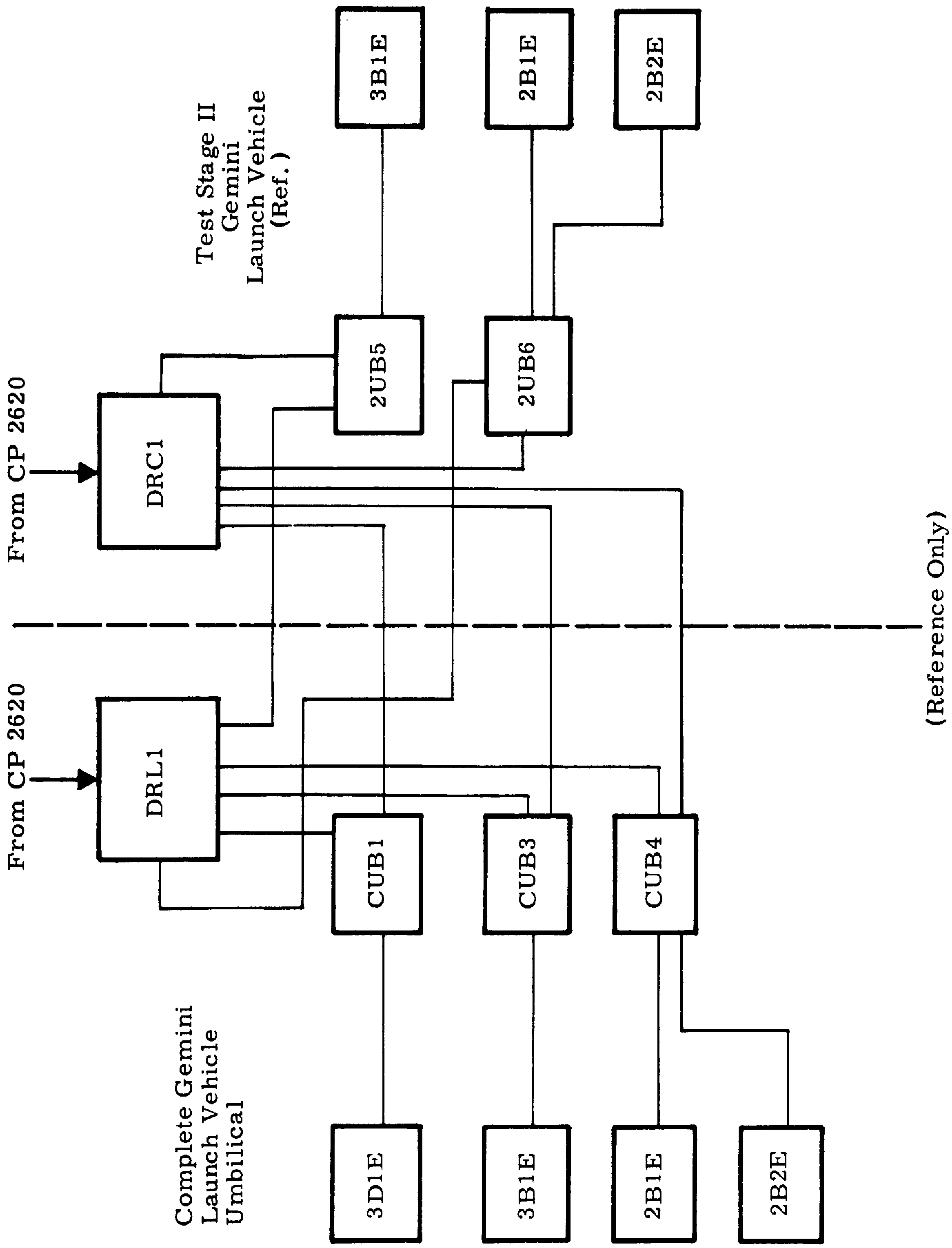


Fig. 7-77. Flight Control System Test Set Cabling (continued)

7.29 NONINSTALLED LAUNCH VEHICLE AGE

Many items of AGE required for launch complex activation are not installed as components of any AGE subsystem. These items vary from portable checkout equipment to mobile transportation devices. Table 7-5 defines the noninstalled launch vehicle AGE by system and control point. This noninstalled AGE, together with the launch vehicle AGE described in the various installation paragraphs of this section, defines the total launch vehicle AGE requirements.

TABLE 7-5

Noninstalled Launch Vehicle AGE

Control Point	Titan Part No.	Title	TP	GSTP	Called Out on Installation Drawing No.	Paragraph Reference
Ground Instrumentation Equipment						
2352	327-2352000	Oscillogram processor (3)	--	--	424-6007000	7.8
6014	327-X014005-9	Headset, telephone (41)	--	--	--	--
6024	327-X024000	Patch cord assembly	--	--	424-6002000	7.8
6200	327-X200000	Test cart	--	--	424-6002000	7.8
6200A	327-X200010	Cart assembly (playback area)	--	--	424-6002000	7.8
6440	PC640300221-1	Datarite (recorder) magazine (2)	--	--	424-6002000	7.8
6740	327-X740000	Oscilloscope test cart (2)	--	--	424-6002000	7.8
6750	327-X750000	VCO test cart	--	--	424-6002000	7.8
6800A	327-X800000-9	General test cart	--	--	424-6002000	7.8
6800B	327-X800000-19	General test cart (playback area)	--	--	424-6007000	7.8
6900	327-X900000	Signal simulator and test equipment	--	--	424-6002000	7.8
Mechanical Service and Environmental Equipment						
1509	804E1009000	Clothing outfit, toxic gas protection (SCAPE) (40)	424-186/AMR 424-187/AMR	--	424-2050000	--
1583	804-	Protective mask and canister set (300)	--	--	--	--
1570	804-	Toxic vapor detection system, portable, AMR (4)	424-185/AMR	--	424-2052000	7.2
5001	804E8001000-009	Portable hydraulic power supply unit (1)	424-977/AMR	424-1042/AMR	424-2050000	--
5022	804E5022000-019	Hydraulic system control box	424-977/AMR	424-1041/AMR	424-9900000 424-2052000	7.3
Mechanical Handling and Transporting Equipment						
1523	804E1023000-009	Vehicle loading ramp	424-778/AMR	--	424-2050000	9.0
1524	804E1024000-019	Cover, protective, launch vehicle Stage I	--	--	--	9.0
1525	804E1025000-019	Cover, protective, launch vehicle Stage II	--	--	--	9.0
1526A	804E1026000-009	Trailer ring, forward, Stage I	424-778/AMR	--	424-2050000	9.0

TABLE 7-5 (continued)

Control Point	Titan Part No.	Title	TP	GSTP	Called Out on Installation Drawing No.	Paragraph Reference
1526B	804E1026000-019	Trailer ring, forward, Stage II	424-778/AMR 424-785/AMR	--	424-2050000	9.0
1527	804E1027000-009	Trailer ring, aft, Stage II	424-778/AMR	--	424-2050000	9.0
1528	804E1028000-009 and 029	Breather sets, propellant tank, Stage I	--	--	424-2050000	9.0
1529	804E1029000-009 804E1028000-029	Breather sets, propellant tank, Stage II	--	--	424-2050000	9.0
1558	804E1058000-019	Trailer, Stage I	424-778/AMR	--	424-2050000	9.0
1559	804E1059000-009	Trailer, Stage II	424-785/AMR 424-778/AMR	--	424-2050000	9.0
5007	801E8007000	Crane, floor, portable and equipment fixtures	424-784/AMR	--	424-2050000	9.0
Sling Set, Stages I and II						
5920	804E8020017-009	Hoisting slings (2)	424-778/AMR	--	424-2050000	7.3, 9.0
	804E8020016-001	Longeron lifting adapter (4)	424-778/AMR	--	424-2050000	9.0
5920	804E8020016-003	Longeron lifting bushing (8)	424-778/AMR	--	424-2050000	9.0
	804E8020015-001	Trailer ring lifting adapters (4)	424-778/AMR	--	424-2050000	9.0
	327-R8870012-019	Trailer ring tap lines--interstage hoist straps (4)	424-778/AMR	--	424-2050000	9.0
5990	804E8020032-029	Hoisting spider, Stage I	424-778/AMR	--	424-2050000	7.23, 9.0
5991	804E8020032-029	Hoisting spider, Stage II	424-778/AMR 424-785/AMR	--	424-2050000	7.23, 9.0
8061	804E8061000	Interstage dolly, Stage II	424-785/AMR	--	Not available	--
Mechanical Maintenance and Test Equipment						
1530	804E1030000-009	Alignment kit, engine	424-283/AMR	--	424-5000000	--
1543	804E1143000-009	Adapter, torque wrench, umbilical	424-783/AMR	--	424-2053000	--
1556	804E1056000-029	Launch thrust mount tool kit	--	424-1035/AMR	424-2050000	7.18
1557	804E1057000-009	Servo actuator tool kit	--	--	424-2050000	--
1721	327-M1721000-9	Ultraviolet lamp	--	--	424-2052000	--
4504	327-4504000-19	Dew-point indicator	--	--	424-2052000	--
4525	327-4525000-39	Weight and thrust measuring system calibration kit	424-490/AMR	--	424-2050000	7.18, 7.19
5940	327-5940000-29	Assembly area maintenance equipment set	--	--	424-5000000	--
1518	Not available	Leak detector kit	--	--	424-5000000	--
5037	804E8038000-009	Guard set, access door sill	--	--	424-2052000	--
5038	804E8038000-009	Maintenance platform, internal	--	--	424-2052000	--
5039A	804E8039000-009	Maintenance safety net set, internal	--	--	424-2050000	7.26
5957	327-5957000-9	Personnel ladders	--	--	--	--
5958	327-5958000-9	Lubricating and servicing unit	--	--	424-2052000	--
5965	327-5965000-9	Console vacuum cleaner	--	--	424-2251000	--
5956	804E8036000-009	Maintenance platform set, test stand	--	--	424-2052000	--
9172	804B9172073-019	Static firing set (bolts)	--	--	424-2052000	7.24
5963A	327-5963000-29	Work platform inside Compartments I and IIB (8 segments)	--	--	424-2052000	--
5963B	Number not assigned	Work platform inside Compartment II (2 segments)	--	--	424-2052000	--
1531	804B-1131014	Maintenance platforms	--	--	424-2052000	--

TABLE 7-5 (continued)

Control Point	Titan Part No.	Title	TP	GSTP	Called Out on Installation Drawing No.	Paragraph Reference
Mechanical Erection Systems						
5842	424-5842000	Ramp set, erector loading (modification)	424-778/AMR	--	424-2052000	7.23
9592	424-9592011	Stabilizing lines installation, Stage I, erector structure, complete launch vehicle	424-778/AMR	--	424-9592000	7.23
9592	424-9592012	Stabilizing lines installation, Stage II, erector structure, complete launch vehicle	424-778/AMR	--	424-9592000	7.23
9592	424-9592013	Stabilizing lines installation, Stage II, erector structure	424-785/AMR	--	424-9592000	7.23
Electrical Maintenance and Test Equipment						
4505	327-4505000-9	28-v Ni-Cad battery charger (hangar area)	424-678/AMR	--	424-2151000	7.4
4506	327-4506000-9	CCTV alignment kit, AMR	--	424-1045/AMR	424-2251000	7.12
4540	327-4540000-19	Electronic maintenance kit	--	--	424-2053000	--
4797	327-4797000-19	Portable 28-v dc dummy load	--	424-1029/AMR	424-9900000 424-2052000	7.4
3350	McDonnell part No. 52E040013-1	Spacecraft simulator, functional (McDonnell-furnished rack)	--	424-1055/AMR	424-2052000	--
5231	327-5231000-9	Gyro test set (rate)--located in Hangar T Gyro Laboratory (Environmental Laboratory, AMR)	424-385/AMR	424-1025/AMR	424-5000000	7.28
5260	327-5260000-9	Explosives continuity checker	424-577/AMR	--	424-2053000	7.24
Ground Checkout and Launch Control Equipment						
4050	804E4600000-009	Stage separation ordnance simulator set	424-576/AMR	--	424-2053000	7.24
4002	804B4002000-009	Destruct system test	424-589/AMR 424-575/AMR	--	424-2052000	7.11
5027	424-5027000-009	Hold-down set, separation nuts	424-577/AMR	--	424-2052000	7.24
Electrical Servicing Equipment						
4793	327-4793000-19	Mobile 28-v dc ground power supply	--	424-1029/AMR	424-2152400	7.4

7.29.1 Noninstalled Engine AGE

Table 7-6 presents a list of the noninstalled engine AGE.

TABLE 7-6

Noninstalled Engine AGE

Title	Aerojet-General Corporation Part No.	G-Number
Dolly, storage	106051	G-40
Stand, maintenance, ETU-22/E	1-236601	-13
Maintenance platform ETU-23/E	1-236606-39	-41
Sling, multiple legged, HLU-35/E	1-240837	-16
Cradle, rocket engine, GSU-71/E	1-243860-19	-21
Cleaning and purging equipment, rocket engine GSU-43/E	243856-9	-49
Trailer, cleaning chemicals and hose storage	243857-19	-44
Adapter, maintenance stand, rocket engine, ADU-107/E	243870-9	-14
Adapter, maintenance stand, rocket engine ADU-106/E	243878-9	-25
Stand, maintenance, turbopump, ETU-53/E	246061-9	-15
Sling, multiple legged, TCA	250008-9	-23
Cover, protective, rocket engine, CVU-33/E	251378-9	-12
Cover, protective, rocket engine, CVU-34/E	251379-9	-11
Truck, thrust chamber, ETU-55/E	251380-9	-18
Cradle, rocket engine, ETU-52/E	255795-19	-22
Pump, rotating, hand driven	257210-9	-43
Closure kit, protective, rocket engine, LR87-AJ-5	257648	-30

TABLE 7-6 (continued)

Title	Part No.	G-Number
Closure kit, protective, rocket engine, LR91-AJ-5	257800	G-31
Sling, thrust chamber skirt	257803-9	-17
Tool kit, rocket engine	258231	-48
Tool kit, turbopump	258240	-46
Test kit, pressure leak, turbopump	258260	-75
Lapping kit, turbopump	258280	-47
Cover, rocket engine, LR87-AJ-5	261663-9	-19
Cover, rocket engine, LR91-AJ-5	261635-9	-24
Took kit, TCA inspection	262410	-77
Plug, thrust chamber, LR91-AJ-5	263400-9	-72
Plug, thrust chamber, LR87-AJ-5	263430-9	-71
Trailer, rail-type, ETU-54/E	265700-9	-10
Pressure controller, rocket engine, LR87-AJ-5	280300-9	-81
Pressure controller, rocket engine, LR91-AJ-5	280400-9	-82
Test set, airborne instrumentation network	280480-9	-80
Test set, rocket engine	280495-9	-74
Test set, variable resistor tracking and setting	280520-9	-83
Connecting kit, instrumentation test set	280540-9	-78
Connecting kit, cleaning system	280555-9	-45
Hoisting unit, vertical TPA-LR87-AJ-5	280565-9	-26

TABLE 7-6 (continued)

Title	Part No.	G-Number
Hoisting unit, vertical, TPA-LR91-AJ-5	280580-9	G-27
Sling, removal, horizontal, TPA-LR87-AJ-5	280595-9	-28
Sling, removal, horizontal, TPA-LR91-AJ-5	280620-9	-29
Gearbox flush and purge set	280640-9	-54
Patch kit, engine, protective cover	280655-9	-57
Test kit, pressure leak, rocket engine	280670-9	76

7.30 SPACECRAFT CABLING INSTALLATION

7.30.1 Description

Spacecraft cabling is required to electrically interconnect the various components of the spacecraft subsystems (Fig. 7-78). This cabling, which permits the functional testing and monitoring of the spacecraft subsystems before and during the launch countdown, consists of the following cable groups and junction boxes:

(1) Blockhouse junction box.

(2) Transfer room junction box.

(3) Umbilical tower junction box.

(4) Cable Group A.

(5) Cable Group B.

(6) Cable Group C.

(7) Cable Group D.

(8) Cable Group E.

(9) Cable Group F.

(10) Cable Group H.

(11) Cable Group J.

(12) Cable Group K.

(13) Cable Group M.

7.30.2 Sequence of Events

7.30.2.1 Blockhouse Junction Box Installation

7.30.2.1.1 Install junction box, 52E200008-1, in the first level of the blockhouse of Location 35, in accordance with Drawing 424-2151000, AGE Installations, Blockhouse, First Floor, Complex 19.

7.30.2.2 Transfer Room Junction Box Installation

7.30.2.2.1 Install junction box, 52E200008-1, in the transfer room, in accordance with Drawing 424-2152400, Equipment Installation, Transfer Room and Lower Equipment Room.

7.30.2.3 Umbilical Tower Junction Box Installation

7.30.2.3.1 Install junction box, 52E200008-1, on the complete vehicle umbilical tower in accordance with Drawing 424-2054500, Junction Box Installation.

7.30.2.4 Pad Complex Cabling Installation

7.30.2.4.1 Install pad complex cabling, 52E200001-1, in accordance with Drawings 52F200101, Cable Routing, Complex 19, Gemini AGE and 424-2050500, Spacecraft Cable Set Installation.

Interconnections are provided between the equipment as shown in Table 7-7.

TABLE 7-7

Pad Complex Cabling Interconnections

Blockhouse

Cable Group D connects telemetry, guidance, communications, recovery, LD and E sequential, reaction control, propulsion and electrical test functions and operating functions between the junction box and spacecraft AGE.

Cable Group K interconnects spacecraft junction box, 52E200008-1, with the Martin junction box.

Tunnel

Cable Group F connects the blockhouse junction box, 52E200008-1, to the transfer room junction box 52E200008-1.

Cable Group M connects the blockhouse junction box, 52E200008-1, to the liquid hydrogen facility.

Approach Ramp Building

Cable Group E connects telemetry, communications, recovery, LO and E sequential, propulsion, reaction control, electrical, guidance and group power systems functions between the transfer room junction box 52E200008-1 and the transfer room equipment and power equipment.

Cable Group J connects GOX service, LOX service and coolant service to the transfer room junction box, 52E200008-1.

Cable Group H connects the transfer room junction box, 52E200008-1, to the umbilical tower junction box, 52E200008-1.

Umbilical Tower

Cable Group A connects the re-entry and adapter section main umbilicals to the umbilical tower junction box, 52E200008-1.

Cable Group B connects the adapter section flight umbilical to the umbilical tower junction box, 52E200008-1.

Cable Group C connects the test umbilicals to the umbilical tower junction box, 52E200008-1.

7.30.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

7.30.4 Documentation

Document No.	Title
424-2050500	Spacecraft Cable Set Installation
424-2054500	Junction Box Installation

Document No.	Title
424-2151000	AGE Installations, Blockhouse, First Floor, Complex 19
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
52F200101*	Cable Routing, Complex 19, Gemini AGE
52E200008-1*	Junction Box

*McDonnell drawing.

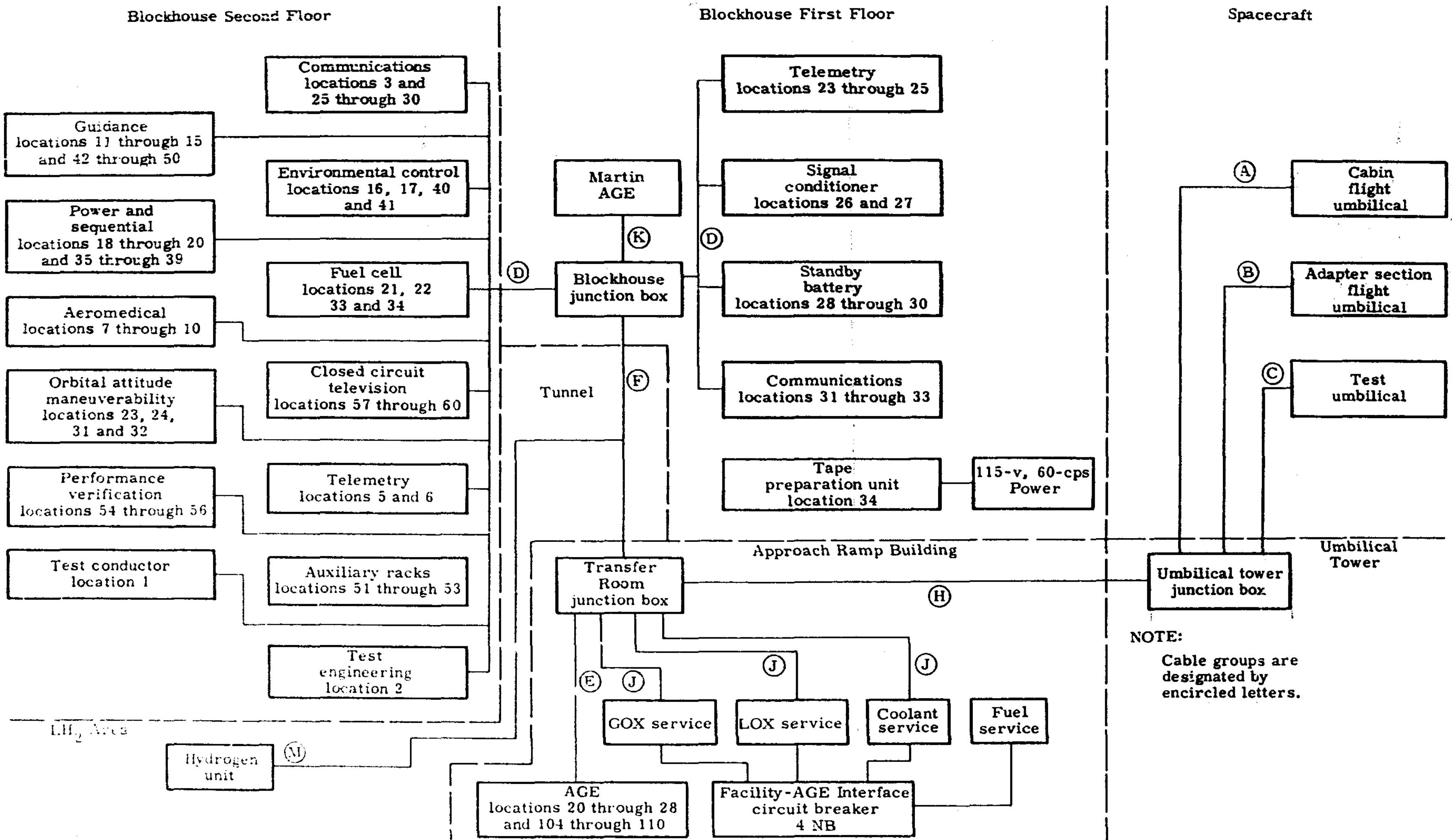


Fig. 7-78. Spacecraft AGE Cabling

7.31 SPACECRAFT FUEL AND OXIDIZER SERVICE SYSTEM INSTALLATION

7.31.1 Description

The Fuel and Oxidizer Service System is used to store and supply fuel and oxidizer to the spacecraft and to provide drain facilities for contaminated waste fuel and oxidizer. The Fuel and Oxidizer Service System consists of the following components:

(1) Fuel service and deservice unit.

(2) Fuel flush and purge unit.

(3) Oxidizer service and deservice unit.

(4) Oxidizer flush and purge unit.

(5) Various hose assemblies.

(6) Fuel and oxidizer service terminal boxes.

(7) Hardline for fuel and oxidizer.

(8) Fuel and oxidizer metering devices.

Fuel is supplied externally from a trailer-mounted unit consisting of a fuel storage tank, a waste fuel tank, gas pressurization system, propellant refrigeration system and other components required for fuel servicing operations of the spacecraft. Oxidizer is supplied externally from a trailer mounted unit consisting of an oxidizer storage tank, a waste oxidizer tank, gas pressurization system, oxidizer refrigeration system and other components for oxidizer transfer functions.

The mobile unit and its connecting hoses are not covered in these procedures, which begin with the associated terminal box and end with the spacecraft connection hoses.

The Fuel and Oxidizer Service Systems shall be installed in accordance with McDonnell Drawing 52F420123.

7.31.2 Sequence of Events

7.31.2.1 Fuel and Oxidizer Service System Installation, Launch Deck (Fig. 7-79)

7.31.2.1.1 Install fuel terminal box 52E420031-1 (point* A), to a support on the launch deck.

7.31.2.1.2 Install oxidizer terminal box 52E420026-1 (point* A), to a support on the launch deck.

7.31.2.1.3 Install oxidizer fill and drain lines, 52E420059-1 (sections* AB, BC and CD), on the launch deck and wrap all oxidizer lines with 1/4-inch J-M thermotape or equal.

7.31.2.1.4 Install fuel fill and drain lines, 52E420058-1 (sections* AB, BC and CD), on the launch deck. Wrap all fuel lines with 1/4-inch J-M thermotape, or equal.

7.31.2.2 Fuel and Oxidizer Fill and Drain Line Installation, Umbilical Tower

7.31.2.2.1 Install oxidizer fill and drain lines, 52E420059-1 (sections* DE and EF), on the Complete Vehicle Umbilical Tower (CVUT).

7.31.2.2.2 Install fuel fill and drain lines, 52E420058-1 (sections* DE and EF), on the CVUT.

7.31.2.3 Fuel and Oxidizer Service System Installation, White Room

7.31.2.3.1 Install fuel terminal boxes 52E420031-1 (points* F, G and H--three required), on top of CVUT and on the side of the white room.

7.31.2.3.2 Install oxidizer terminal boxes 52E420026-1 (points* F, G and H--three required) on top of the CVUT and on the side of the white room.

7.31.2.3.3 Install fuel fill and purge hose assembly, 52E420032-1 (section* FG), between terminal boxes at F and G.

7.31.2.3.4 Install oxidizer fill and purge hose assembly, 52E420033-1 (section* FG), between terminal boxes at F and G.

7.31.2.3.5 Install fuel fill and drain line, 52E420058 (sections* HI, IJ, JK, KL, LM, LN and MO), on the wall of the white room.

*In Fig. 7-79.

7.31.2.3.6 Install oxidizer fill and drain line 52E420059-1 (sections* HI, IJ, JK, KL, LM, LN and MO) on the wall of the white room.

7.31.2.3.7 Install oxidizer terminal box, 52E420026-1 (point* N), on the wall of the white room.

7.31.2.3.8 Install fuel terminal box, 52E420031-1 (point* O), on the wall of the white room.

7.31.2.3.9 Install oxidizer hose assembly, 52E420045-1 (section* NP), between terminal box N and oxidizer metering unit P and the spacecraft.

7.31.2.3.10 Install fuel hose assembly, 52E420044-1 (section* OP), between terminal box O and fuel metering unit P and the spacecraft.

7.31.2.3.11 Install oxidizer metering unit, 52E420025-1 (point* P), in the white room.

7.31.2.3.12 Install fuel metering unit, 52E420012-1 (point* P), in the white room.

7.31.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.31.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)

*In Fig. 7-79.

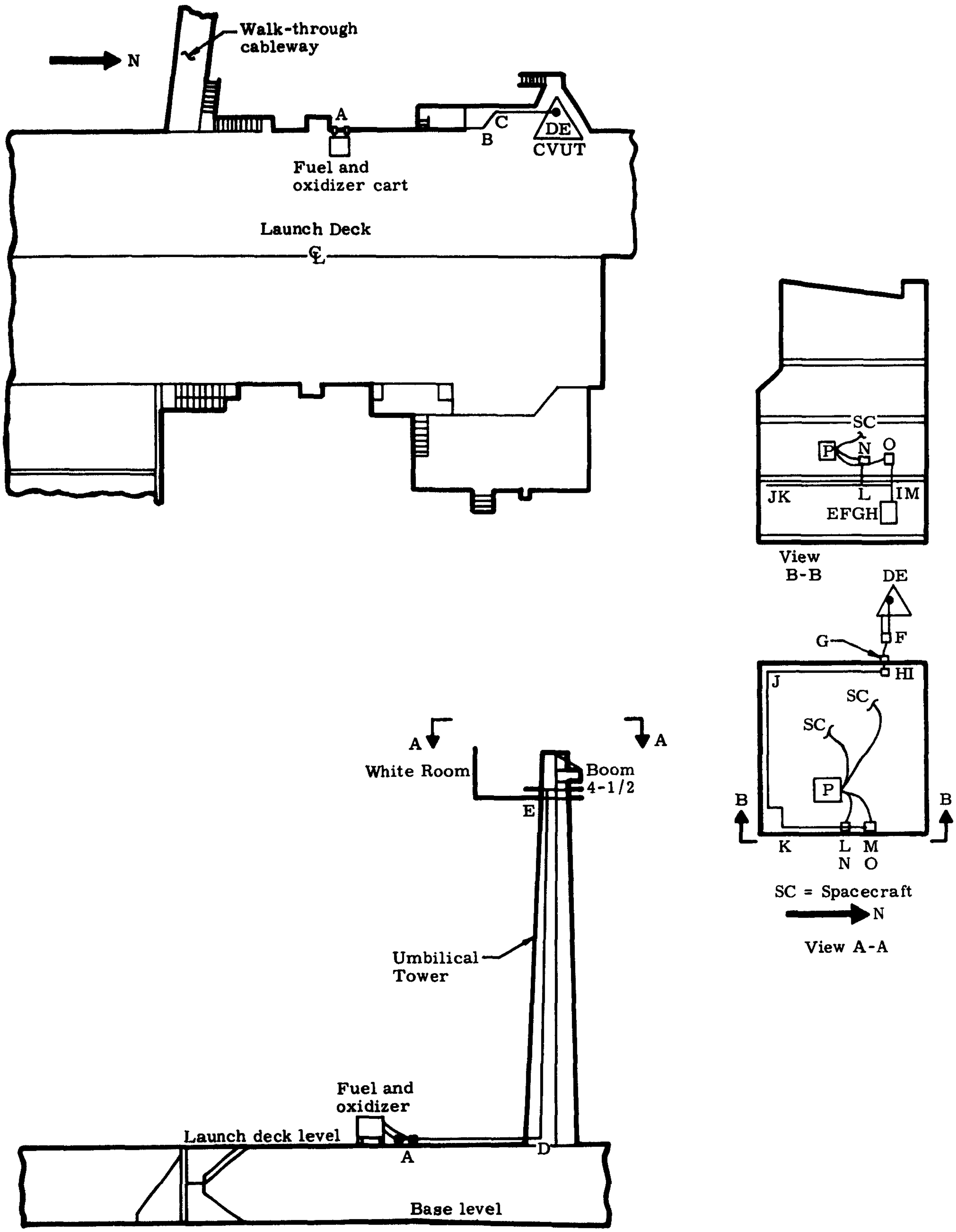


Fig. 7-79. Fuel and Oxidizer Service System

7.32 SPACECRAFT LIQUID HYDROGEN SERVICE SYSTEM INSTALLATION

7.32.1 Description

The Liquid Hydrogen (LH_2) Service System is necessary to supply about 45 gallons of liquid hydrogen to the spacecraft for use in the reactant supply fuel cell. The LH_2 Service System consists of the following items:

(1) LH_2 service trailer.

(2) Hose assemblies (trailer to terminal box, CVUT to white room, and control panel to spacecraft).

(3) LH_2 terminal boxes.

(4) Liquid hydrogen control panel.

(5) LH_2 hardline (Dewar).

The liquid hydrogen is supplied to the system from a mobile trailer via a flexible hose. It goes to the LH_2 control panel which provides a safe means of controlling the flow of LH_2 to the spacecraft for prelaunch servicing of the reactant supply fuel cell. This control panel is wall mounted and is capable of inspection seal certification of all external disconnect points. The system contains parallel plumbing for supply and vent functions.

The mobile unit and its connecting hoses are not covered in these procedures which begin with the associated terminal box and end with spacecraft connection plumbing.

The Liquid Hydrogen System components are installed in accordance with McDonnell Drawing 52F420123.

7.32.2 Sequence of Events

7.32.2.1 Liquid Hydrogen Service System Installation, Launch Deck (Fig. 7-80)

7.32.2.1.1 Install LH_2 terminal box, 52E230056-1 (point* A), on the launch deck wall.

*In Fig. 7-80.

7.32.2.1.2 Install LH_2 hardline supply, 52E230051-1 (section* AB), on the launch deck wall.

7.32.2.1.3 Install LH_2 hardline vent, 52E230050-1 (section* AB), on the launch deck wall.

7.32.2.1.4 Install LH_2 hardline supply, 52E230050-1 (sections* BC, CD and DE), on the launch deck.

7.32.2.1.5 Install LH_2 hardline vent, 52E230051-1 (sections* BC, CD and DE), on the launch deck.

7.32.2.2 Liquid Hydrogen Service System Installation, CVUT and White Room

7.32.2.2.1 Install LH_2 hardline supply, 52E230051-1 (sections* EF and FG), on the complete vehicle umbilical tower (CVUT).

7.32.2.2.2 Install LH_2 hardline vent (sections* EH and FG) on the CVUT.

7.32.2.2.3 Install LH_2 terminal boxes, 52E230036-1 (points* G and H), on the CVUT and the white room wall.

7.32.2.2.4 Install LH_2 supply hose assembly, tower to the white room 52E230029-1 (section* GH), between the terminal boxes.

7.32.2.2.5 Install LH_2 vent hose assembly, tower to the white room, 52E230030-1 (section* GH), between the terminal boxes.

7.32.2.2.6 Install LH_2 hardline supply, 52E230051-1 (section* HI), on the wall in the white room.

7.32.2.2.7 Install LH_2 hardline vent, 52E230050 (section* HI), on the white room wall.

7.32.2.2.8 Install LH_2 control panel, 52E230033-1 (point* I), on the white room wall.

*In Fig. 7-80.

7.32.2.2.9 Install LH_2 supply hose assembly, control panel to the spacecraft, 52E230031-1 (point I to the spacecraft), between the control panel and spacecraft.

7.32.2.2.10 Install LH_2 vent hose assembly, spacecraft to the control panel, 52E230032-1 (spacecraft to point I), between the spacecraft and the control panel.

7.32.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.32.4 Documentation

Document No.	Title
52FA20123	Plumbing Routing, Complex 19, Gemini AGE (Revision E)
52E230018	LH_2 Supply Line, Work Statement (McDonnell)
52F230019	LH_2 Vent Line, Work Statement (McDonnell)

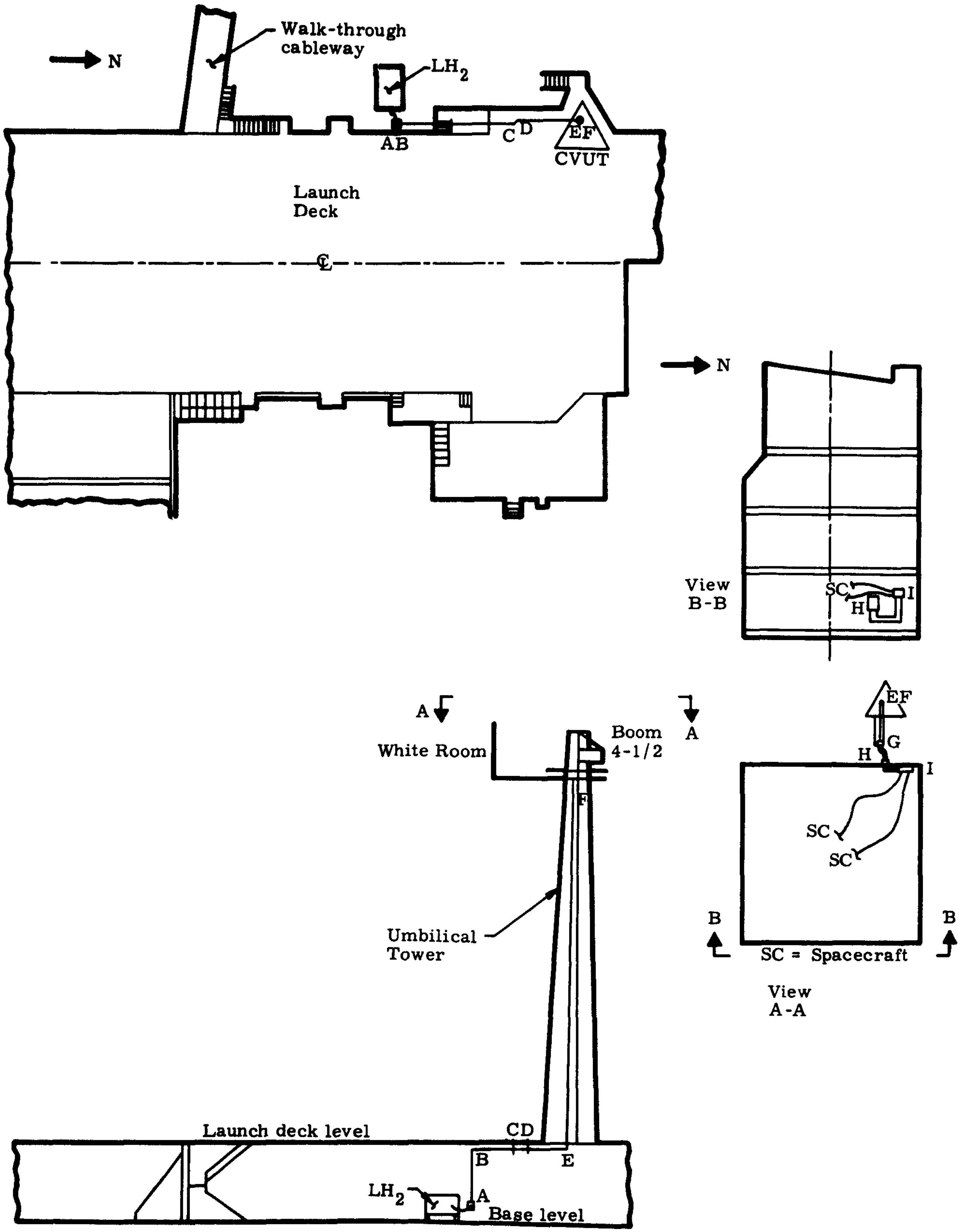


Fig. 7-80. Liquid Hydrogen Service System

7.33 SPACECRAFT HELIUM SERVICE SYSTEM INSTALLATION

7.33.1 Description

The Helium Service System is an assembly consisting of the following units:

(1) Helium service unit.

(2) Helium cart hose assembly.

(3) Helium terminal box (three required).

(4) Helium hardline (service unit to white room).

(5) Helium pressure regulator (two required).

(6) Hose assembly (regulator to spacecraft).

(7) Hose assembly (umbilical tower to white room).

This system is necessary to charge the Reaction Control System (RCS) and the Orbital Attitude Maneuvering System (OAMS) helium pressurant storage tank. The OAMS incorporates a pressure tank for storing gaseous helium to pressurize the system's fuel and oxidizer bladder. This tank also supplies helium gas when pressure is required for expulsion of fuel and oxidizer for system drain during flushing and purging.

Helium gas is supplied externally from the helium service unit via terminal boxes and hardline to the helium pressure regulator assembly. This unit allows regulated 0 to 3000 psi and 0 to 500 psi helium to be supplied to the spacecraft.

The Helium Service System components shall be installed in accordance with McDonnell Drawing 52F420123.

7.33.2 Sequence of Events

7.33.2.1 Gaseous Helium Service System Installation, Launch Deck (Fig. 7-81)

7.33.2.1.1 Install helium terminal box, 52E420027-1 (point A in Fig. 7-81), on the launch deck wall.

7.33.2.1.2 Install hardline, 52E420060-1 (section* AB), on the launch deck wall.

*In Fig. 7-81.

7.33.2.1.3 Install hardline, 52E420060-1 (sections* BC, CD and DE) on the launch deck.

7.33.2.2 Gaseous Helium Service System Installation, Complete Vehicle Umbilical Tower

7.33.2.2.1 Install hardline, 52E420060-1 (sections* EF) on the Complete Vehicle Umbilical Tower (CVUT).

7.33.2.3 Gaseous Helium Service System Installation, White Room

7.33.2.3.1 Install helium service hose assembly, 52E420038-1 (section* GH), from the top of the CVUT to the terminal box in the white room.

7.33.2.3.2 Install helium terminal box 52E420027-1 on the side of the white room (point* H).

7.33.2.3.3 Install hardline, 52E420060-1 (sections* HI, IJ, JK and JL), on the walls of the white room.

7.33.2.3.4 Install helium pressure panel, 52E420014-1 (points* K and L), on the wall of two levels of the white room.

7.33.2.3.5 Install helium hose assembly 52E420030-1, pressure panel to spacecraft (points* K and L).

7.33.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.33.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)

*In Fig. 7-81.

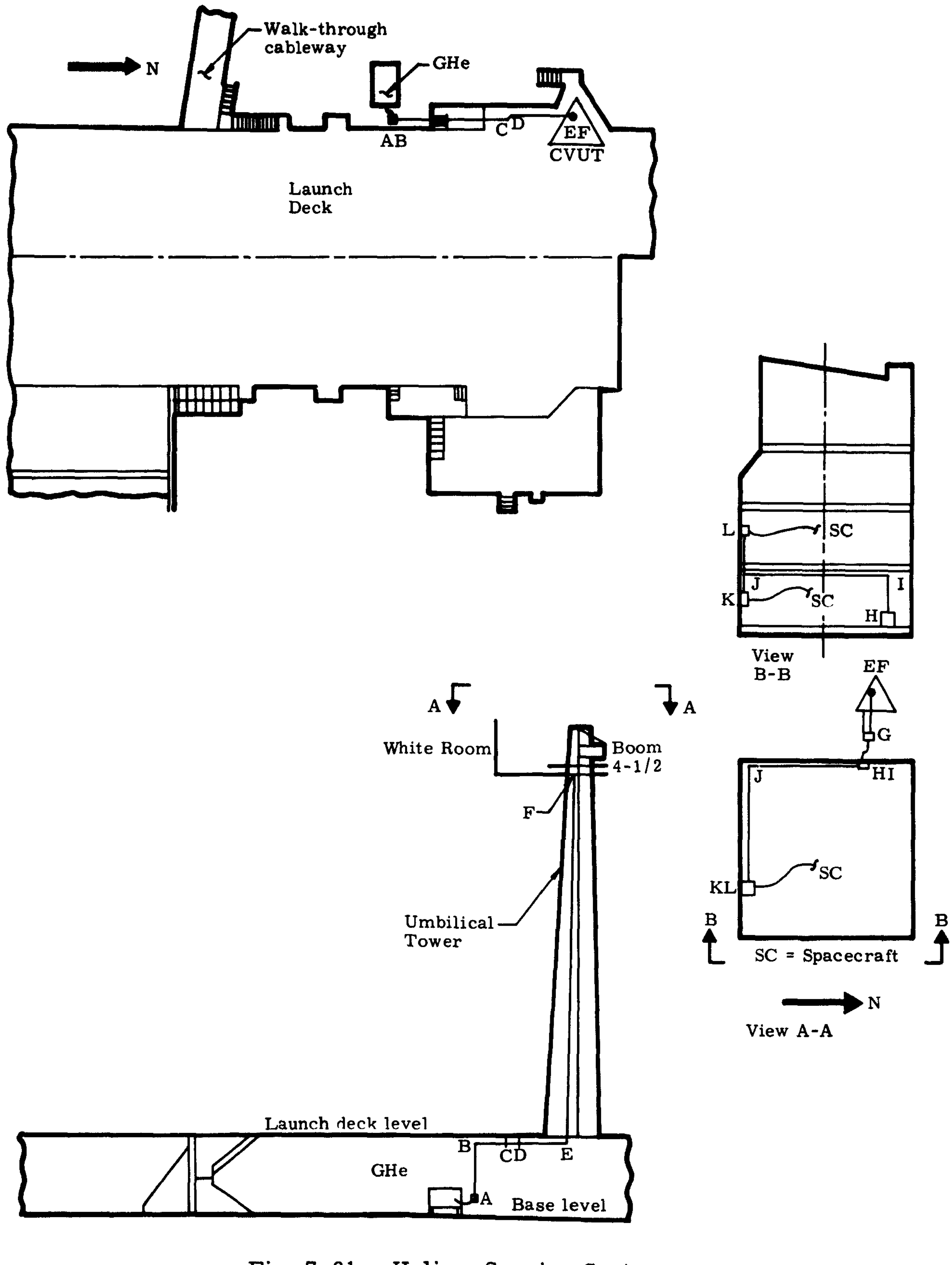


Fig. 7-81. Helium Service System

7.34 SPACECRAFT LIQUID OXYGEN SERVICE SYSTEM INSTALLATION

7.34.1 Description

The Liquid Oxygen (LOX) Service System supplies liquid oxygen to the spacecraft for use in the Environmental Control System (ECS) primary oxygen supply bottle and in the Electrical System fuel cell. The system consists of the following items:

(1) LOX service trailer.

(2) Flexible hose assemblies.

(3) Terminal boxes.

(4) LOX control panel.

(5) LOX hardline.

Liquid oxygen is supplied from a mobile trailer through flexible hose and hardline. It travels via the hardline up the umbilical tower to a control panel, which provides a safe means of controlling the flow of LOX for prelaunch servicing of the spacecraft. The system contains parallel plumbing to accomplish fill and vent functions. Vent lines must be capable of handling the gaseous oxygen resulting from boiloff as well as liquid oxygen resulting from overflow during fill operations. The mobile installation and its connecting hoses are not covered in these procedures which begin with the associated terminal box and end with spacecraft connection hoses.

The LOX system components shall be installed in accordance with McDonnell Drawing 52F420123.

7.34.2 Sequence of Events

7.34.2.1 Liquid Oxygen Service System Installation, Launch Deck (Fig. 7-82)

7.34.2.1.1 Install LOX terminal box, 52E180071-1 (point* A), on the launch deck wall.

7.34.2.1.2 Install LOX supply hardline, 52E180063-1 (section* AB), on the launch deck wall.

7.34.2.1.3 Install LOX vent hardline, 52E180064 (section* AB), on the launch deck wall.

*In Fig. 7-82.

7.34.2.1.4 Install LOX supply hardline, 52E180063-1 (sections* BC, CD and DE), on the launch deck.

7.34.2.1.5 Install LOX vent hardline, 52E180064-1 (sections* BC, DC and DE), on the launch deck.

7.34.2.2 Liquid Oxygen Service System Installation, CVUT and White Room

7.34.2.2.1 Install LOX supply hardline, 52E180063-1 (sections* EF and FG), on the CVUT.

7.34.2.2.2 Install LOX vent hardline, 52E180064-1 (sections* EF and FG), on the CVUT.

7.34.2.2.3 Install LOX terminal box, 52E180035-1 (points* G and H), on the umbilical tower and the white room wall (two required).

7.34.2.2.4 Install LOX supply hose assembly, 52E180043-1 (section* GH), between the umbilical tower and the white room.

7.34.2.2.5 Install LOX vent hose assembly, 52E180070-1 (section* GH), between the umbilical tower and the white room.

7.34.2.2.6 Install LOX supply hardline, 52E180063-1 (section* HI), on the white room wall.

7.34.2.2.7 Install LOX vent hardline, 52E180064-1 (section* HI), on the white room wall.

7.34.2.2.8 Install LOX control unit, 52E180053-1 (Point* I), on the white room wall.

7.34.2.2.9 Install LOX supply hose assembly, 52E180054-1 (point* I to the spacecraft), between the LOX control unit and the spacecraft (two required).

7.34.2.2.10 Install LOX vent hose assembly, 52E180051-1 (point* I to the spacecraft), between the LOX control unit and the spacecraft (four required).

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*In Fig. 7-82.

7.34.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.34.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)
52E180029-1	McDonnell Work Statement, LOX Supply Line
52E180031-1	McDonnell Work Statement, LOX Vent Line

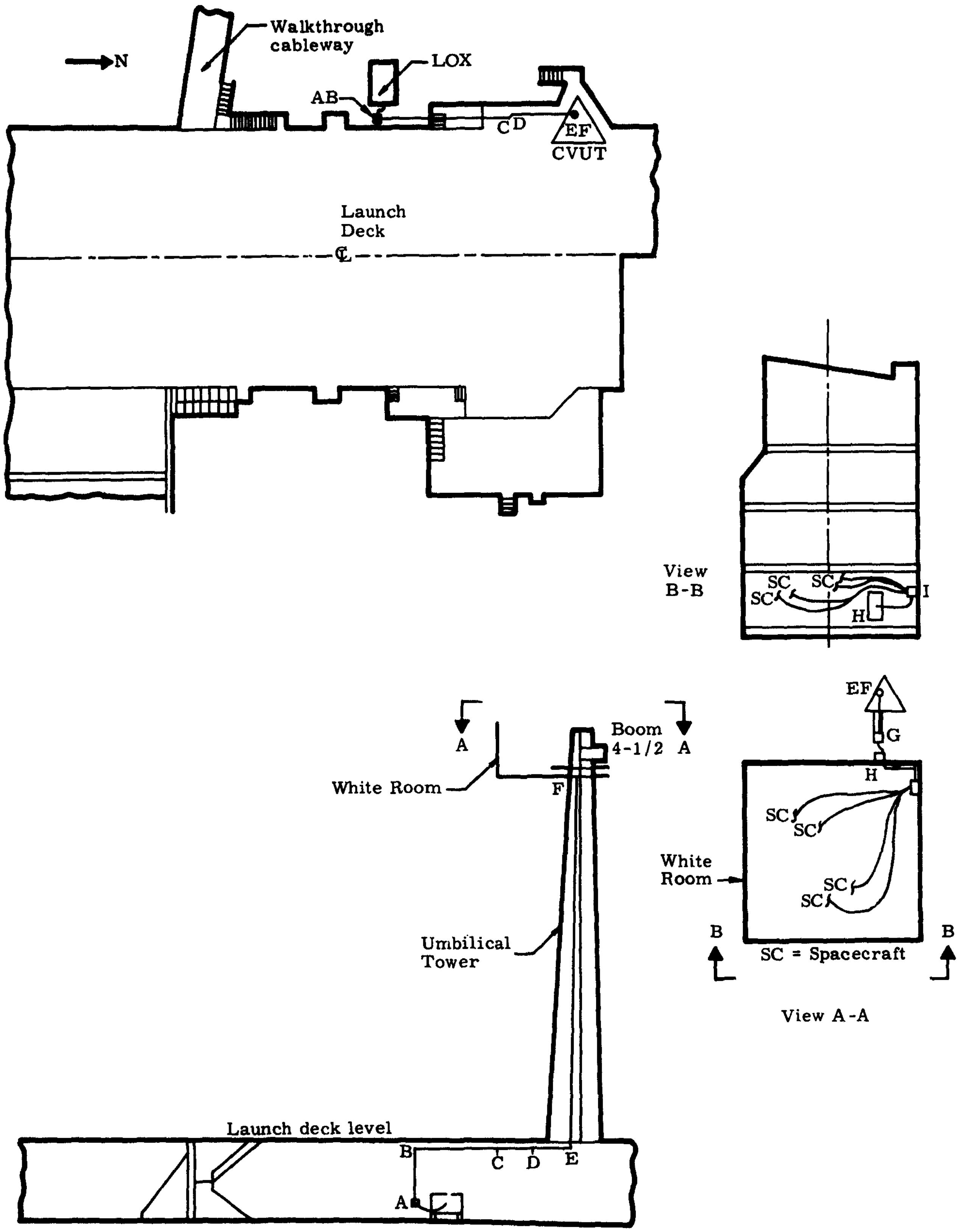

Fig. 7-82. Liquid Oxygen Service System

7.35 SPACECRAFT HIGH PRESSURE NITROGEN SERVICE SYSTEM INSTALLATION

7.35.1 Description

The Nitrogen Service System supplies gaseous nitrogen at high pressure to the spacecraft for servicing the parawing tanks and to charge the RCS and OAMS nitrogen pressurant tanks. Nitrogen is supplied from a mobile trailer containing liquid nitrogen and a converter to change the liquid nitrogen to high pressure gaseous nitrogen (GN_2). The GN_2 is transferred to the system via appropriate terminal boxes and hardline. The GN_2 is then fed to a nitrogen pressure regulator control panel which supplies 3500-psi regulated nitrogen to the spacecraft. The Nitrogen Service System consists of the following items:

(1) Liquid nitrogen storage unit.

(2) LN_2-to-GN_2 converter unit.

(3) GN_2 hose assemblies.

(4) GN_2 terminal box.

(5) GN_2 hardline.

(6) Nitrogen regulator control panel.

The mobile installation and its connecting hoses are not covered in these procedures which begin with the associated terminal boxes and end with the spacecraft connection hoses.

The high pressure nitrogen system components shall be installed in accordance with McDonnell Drawing 52F420123.

7.35.2 Sequence of Events

7.35.2.1 High Pressure Nitrogen Service System Installation, Launch Deck (Fig. 7-83)

7.35.2.1.1 Install terminal box, 52E420028-1 (point* A), on the launch deck wall.

---

*In Fig. 7-87.

7.35.2.1.2 Install GN_2 high pressure hardline, 52E420061-1 (sections* AB and BC), on the launch deck wall.

7.35.2.1.3 Install GN_2 high pressure hardline, 52E420061-1 (section* CD), on the launch deck wall.

7.35.2.1.4 Install GN_2 high pressure hardline, 52E420061-1 (sections* DE, EF, FG, GH, HI, IJ, JK and KL), on the launch deck.

7.35.2.2 High Pressure Nitrogen Service System Installation, CVUT and White Room

7.35.2.2.1 Install GN_2 high pressure hardline, 52E420061-1 (sections* LM and MN), on the CVUT.

7.35.2.2.2 Install GN_2 terminal box, 52E420028-1 (points* N and O), on the umbilical tower and the white room wall (two required).

7.35.2.2.3 Install flexible nitrogen lines, 52E360005-1 (section* NO), between the terminal boxes on the umbilical tower and the white room wall.

7.35.2.2.4 Install GN_2 high pressure hardline, 52E420061-1 (sections* OP, PQ, QR, RS, ST, TU, UV, VW, WX, XY and YZ), on the walls in the white room.

7.35.2.2.5 Install GN_2 control panel, 52E420013-1 (points* R and U), on the white room wall.

7.35.2.2.6 Install GN_2 low pressure terminal box, 52E420050-1 (point* Z), on the white room wall.

7.35.2.2.7 Install GN_2 hose assembly, 52E420029-1 (point* R to the spacecraft), between the N_2 control panel and the spacecraft.

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*In Fig. 7-83.

7.35.2.2.8 Install GN_2 hose assembly, 52E360007-1 (point* R to the spacecraft), between the control panel and the spacecraft.

7.35.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.35.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)

*In Fig. 7-83.

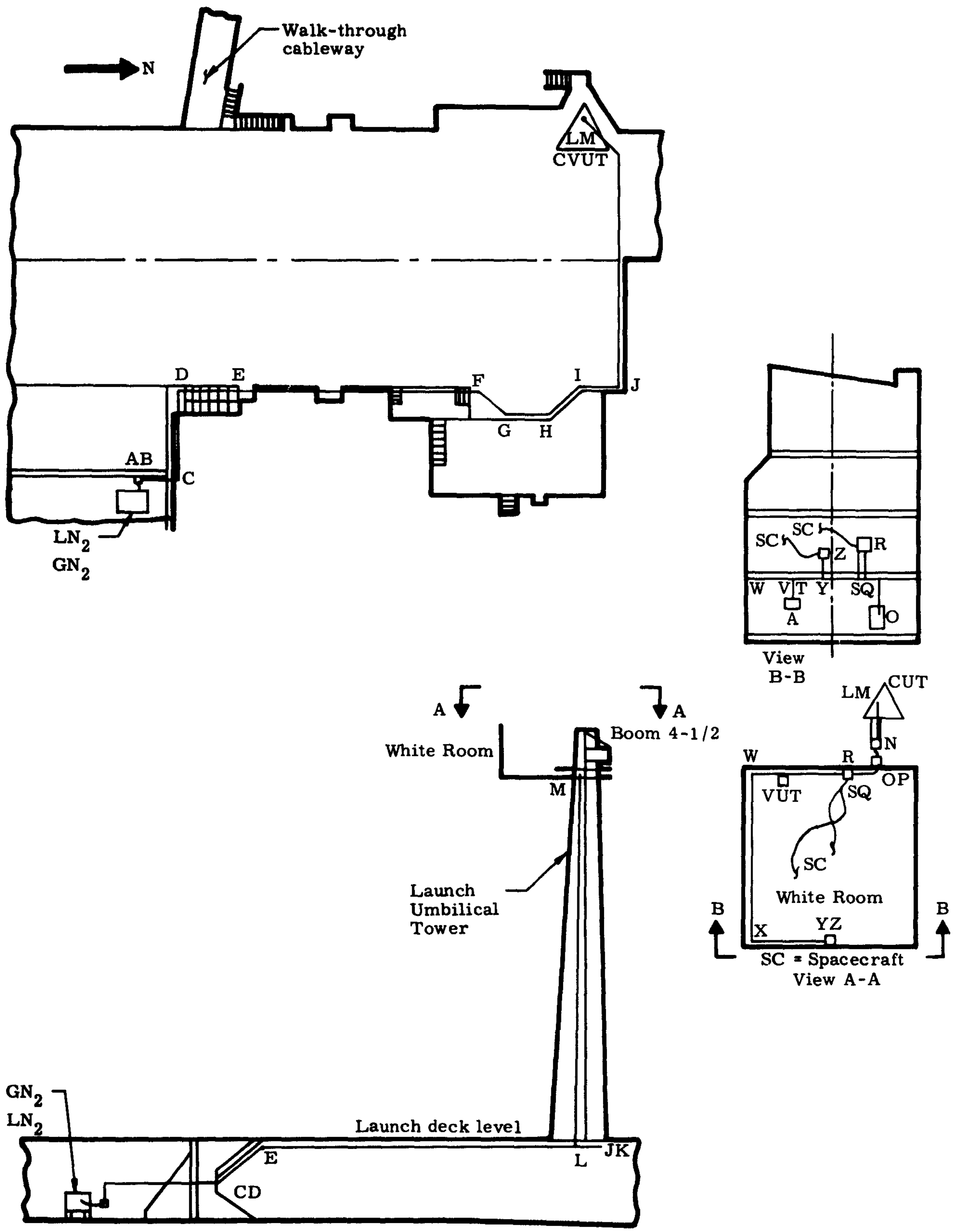


Fig. 7-83. High Pressure Nitrogen System

7.36 SPACECRAFT FACILITY NITROGEN SYSTEM INSTALLATION

7.36.1 Description

The facility nitrogen supplied to the spacecraft is obtained from the spacecraft/AGE interface. The facility nitrogen installation preceding that described here, is described in paragraph 7.5, Launch Vehicle Pneumatic System Installation, and is shown in Fig. 7-85. The Facility Nitrogen System utilized for spacecraft AGE consists of the following items:

(1) N_2 hardline.

(2) N_2 two-stage regulator.

(3) N_2 hose assembly (umbilical to white room).

(4) N_2 quick disconnects (11 required).

The two-stage regulator reduces the pressure of the nitrogen to allow its utilization for pressurization of the complex junction box located at the top of the CVUT. Snaptite quick disconnects are used. The supply line goes up the umbilical tower, in accordance with the Launch Vehicle Pneumatic System installation procedures.

The Facility Nitrogen System components shall be installed in accordance with McDonnell Drawing 52F420123.

7.36.2 Sequence of Events

7.36.2.1 Facility Nitrogen System Installation, CVUT and White Room (Fig. 7-84)

7.36.2.1.1 Install nitrogen low pressure hardline, 52E420062-1 (section* AB), on top of the umbilical tower.

7.36.2.1.2 Install two-stage umbilical junction box pressure regulator, 52E420056-1 (point* A), on top of the umbilical tower.

7.36.2.1.3 Install nitrogen low pressure hardline, 52E420062-1 (point* A), between the supply line and the junction box regulator.

---

*In Fig. 7-84.

7.36.2.1.4 Install nitrogen snaptite quick disconnect fittings (points* B and C), on the umbilical tower and the white room wall access panel (two required).

7.36.2.1.5 Install nitrogen flexible hose assembly, 52E420042-1 (section* BC), between the quick disconnects on the umbilical tower and white room.

7.36.2.1.6 Install nitrogen low pressure hardline, 52E420062-1 (sections* CD, DE, EF, EG, GH, EI, IJ, JK, JL, LM, JN, NO, OP, OQ and QR), on the white room walls.

7.36.2.1.7 Install nitrogen snaptite quick disconnect fittings (points* F, G, H, K, L, M, P, Q and R), on white room walls (nine required).

7.36.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.36.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)

*In Fig. 7-84.

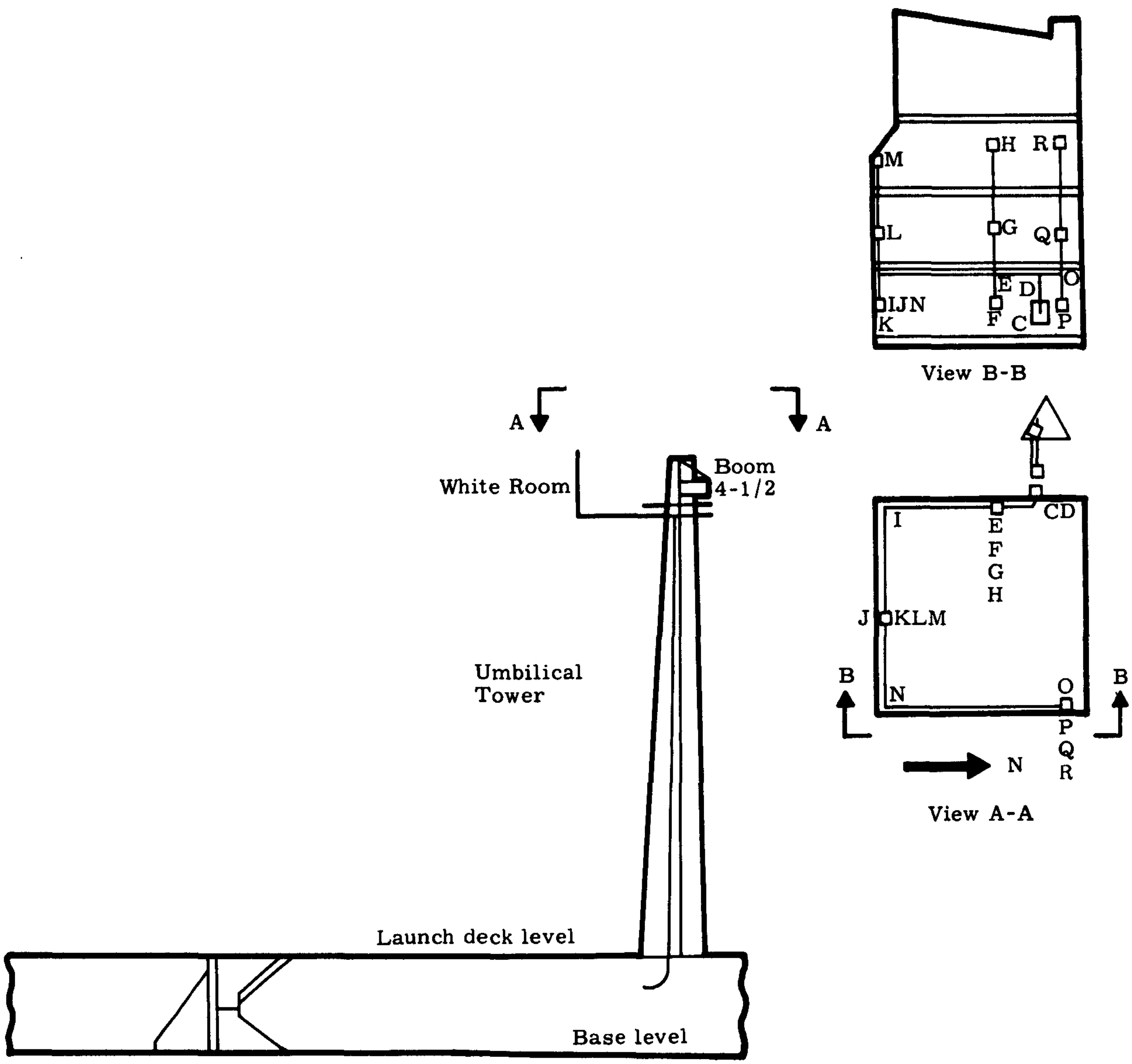


Fig. 7-84. Facility Nitrogen Service System

7.37 SPACECRAFT GASEOUS OXYGEN PURGE SYSTEM INSTALLATION

7.37.1 Description

The Gaseous Oxygen (GOX) Purge System supplies gaseous oxygen for the cabin pressure test, suit purge and the Environmental Control System (ECS) tests. The GOX Purge System consists of the following items:

(1) GOX service cart.

(2) GOX terminal boxes.

(3) GOX hardline.

(4) GOX low pressure regulator panel assembly.

(5) GOX flexible hose assembly.

(6) Spacecraft leakage tester.

The GOX is supplied from a service cart containing equipment to manifold twelve "K" bottles of oxygen. It is transferred by a flexible hose and a terminal box to the hardline which runs up the CVE to the white room. In the white room, the GOX is fed to a low pressure regulator assembly which, with the necessary valves, gages and fittings, accomplishes spacecraft servicing.

The spacecraft leakage tester is a portable unit housing gages, flowmeters, regulators and valves to pressurize, from an external source, and leak test the re-entry module, the suit circuit, the oxygen tanks and to purge the cabin and suit circuit. The leakage tester is connected to the spacecraft by flexible hose. The mobile unit and its hoses are not included in these installation procedures, which begin with the associated terminal box and end with the spacecraft connection hoses.

The Gaseous Oxygen Purge System components shall be installed in accordance with McDonnell Drawing 52F420123.

7.37.2 Sequence of Events

7.37.2.1 Gaseous Oxygen Purge System Installation, Erector Face (Fig. 7-86)

7.37.2.1.1 Install terminal box, 52E180037-1 (point *A), on the erector south face.

*In Fig. 7-85.

7.37.2.1.2 Install gaseous oxygen hardline, 52E180068-1 (section *AB), on the erector south face.

7.37.2.2 Gaseous Oxygen Purge System Installation, White Room

7.37.2.2.1 Install low pressure gaseous oxygen regulator panel, 52E180039-1 (point *B), on the east wall of the white room.

7.37.2.2.2 Install spacecraft leakage tester, 52E180027-1 (point *C), on the floor of the white room.

7.37.2.2.3 Install gaseous oxygen flexible hose, 52E180049-1 (section *B to spacecraft), between the gaseous oxygen regulator panel and the spacecraft.

7.37.2.2.4 Install gaseous oxygen flexible hose, 52E180049-1 (section *C to spacecraft), between the spacecraft leakage tester and the spacecraft.

7.37.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.37.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE, McDonnell (Revision F)

*In Fig. 7-85.

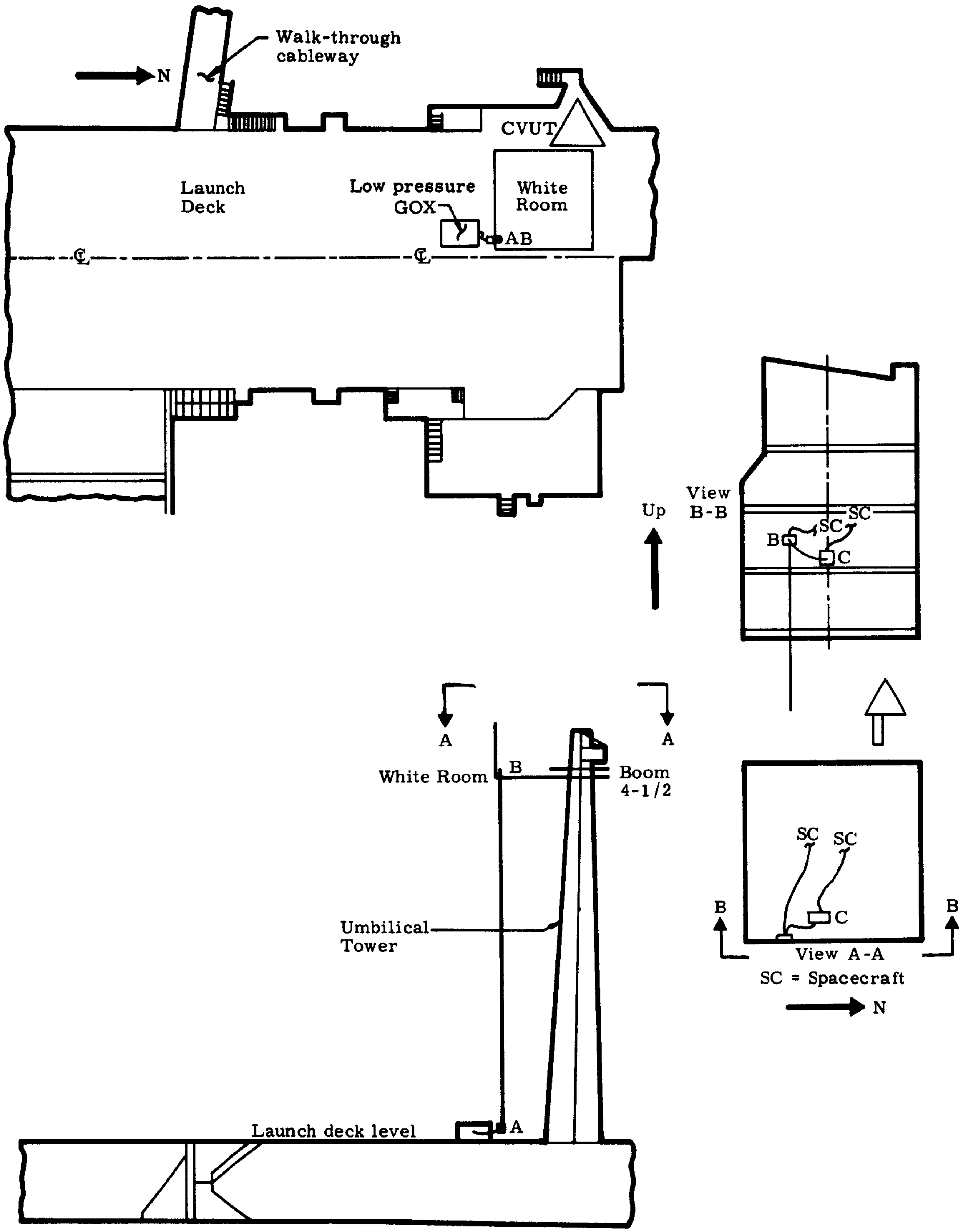


Fig. 7-85. Gaseous Oxygen Purge System

7.38 SPACECRAFT GASEOUS OXYGEN HIGH PRESSURE SERVICE SYSTEM INSTALLATION

7.38.1 Description

The Gaseous Oxygen (GOX) High Pressure System provides equipment for ground storage of liquid oxygen (LOX), its conversion to high pressure GOX and a delivery system to the secondary oxygen bottles used in the spacecraft for environmental control and egress. This system has the following components:

(1) LOX service unit.

(2) LOX to GOX converter service unit.

(3) Various hose assemblies.

(4) GOX terminal boxes.

(5) Hardline for GOX.

(6) GOX high pressure regulator panel assembly.

The LOX is maintained in a 500-gallon trailer tank from which it is supplied to the convertor-compression service unit for conversion to a gas and compressed for delivery to storage bottles on the spacecraft.

The mobile unit, the converter and connecting hoses are not described in these procedures, which begin with the associated terminal box and end with the spacecraft connection hoses.

7.38.2 Sequence of Events

7.38.2.1 GOX High Pressure Service System Installation, Launch Deck

The installation of the GOX high pressure system shall be in accordance with McDonnell Drawing 52F420123.

7.38.2.1.1 Install GOX terminal box, 52E180038-1, to supports on the launch deck wall (point *A).

7.38.2.1.2 Install two 1/4-inch Aminco lines, 52E180067-1, for high pressure GOX along the launch deck structure (from points *A to B).

---

*In Fig. 7-86.

Provide for expansion and contraction by using loops, and separate the lines by 3 inches.

7.38.2.2 GOX High Pressure Service System Installation, CVUT

7.38.2.2.1 Install two 1/4-inch Aminco lines, 52E180067-1, up the umbilical tower (from points* B to C and E to D).

Provide for expansion and contraction, by using loops, and separate the lines by 3 inches.

7.38.2.2.2 Install GOX terminal box, 52E180038-1, to the supports at point D on the CVUT (Fig. 7-86).

7.38.2.3 GOX High Pressure Service System Installation, White Room

7.38.2.3.1 Install GOX terminal box, 52E180038-1, to the support on the side of the white room (point* E).

7.38.2.3.2 Install two 1/4-inch Aminco lines, 52E180067-1, in the white room.

Provide for expansion and contraction during installation, and separate the lines by 3 inches (points* F and G).

7.38.2.3.3 Install GOX high pressure regulator panel assembly, 52E180030-1, in the white room (point* G).

7.38.2.3.4 Install hose assembly, 52E180050-1, between terminal boxes on the CVUT and the white room (points* D to E).

7.38.2.3.5 Install hose assembly, 52E180052-1, from the high pressure regulator (point G) to the spacecraft.

7.38.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.38.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE (Revision F)

*In Fig. 7-86.

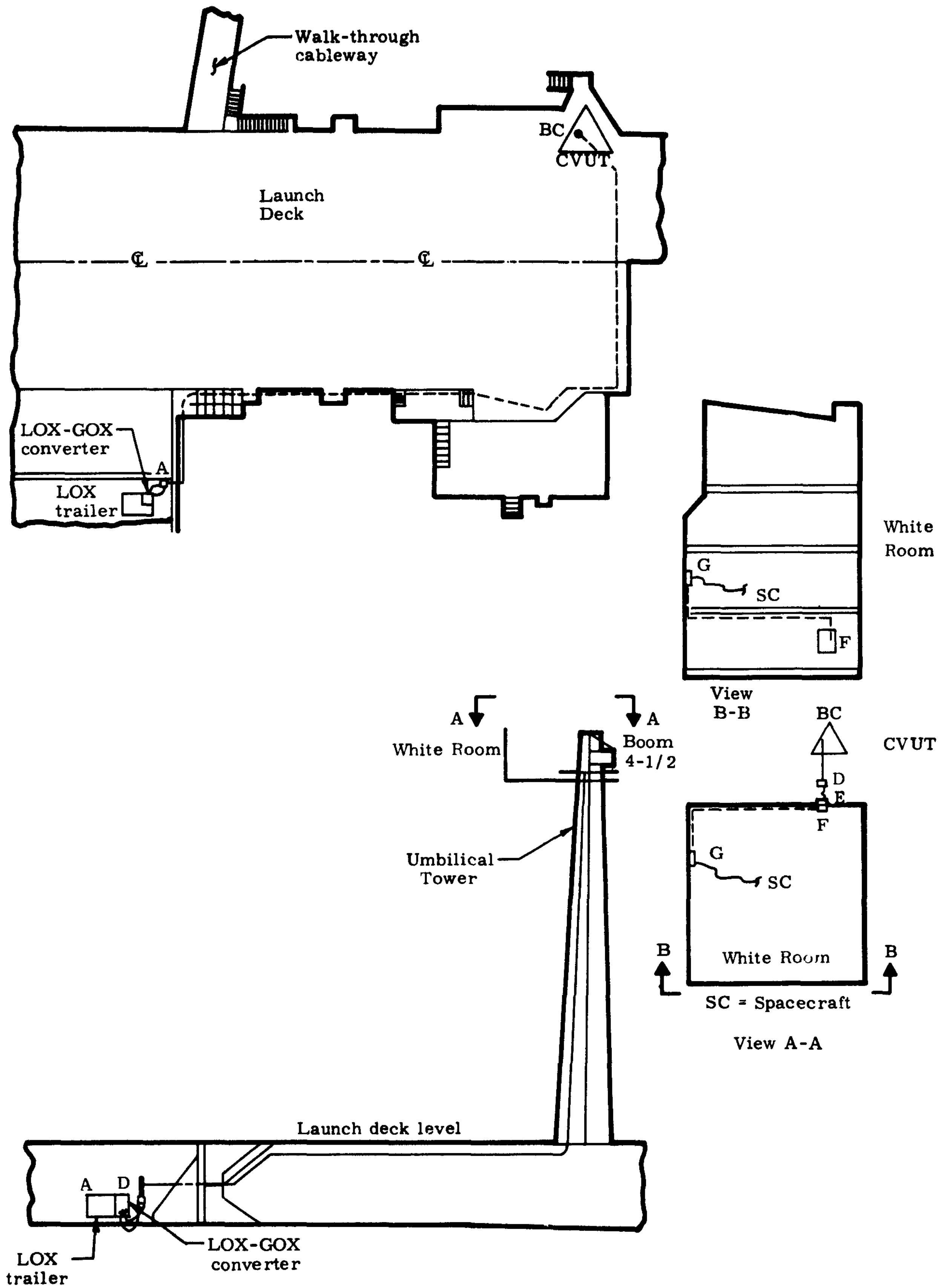


Fig. 7-86. Gaseous Oxygen High Pressure Service System

7.39 SPACECRAFT GROUND COOLANT SYSTEM INSTALLATION

7.39.1 Description

The Ground Coolant System provides equipment for the storage of cooling media and a supply and return distribution system to the spacecraft via the CVUT and boom No. 4-1/2. It has the following components.

(1) Coolant unit.

(2) Various hose assemblies.

(3) Terminal box.

(4) Hardlines for coolant supply and return.

The coolant supplied to the spacecraft has as its source a mobile unit located on the east side of the approach ramp building. Its purpose is to provide spacecraft equipment cooling and pilot suit and cabin cooling. The system is used during spacecraft system test and countdown and is controlled from the blockhouse.

The mobile unit and connecting hoses are not covered during these procedures which begin with the associated terminal box and end with the spacecraft connection hoses.

The Ground Coolant System installation procedures (Fig. 7-87) are carried out in accordance with McDonnell Drawing No. 52F420123.

7.39.2 Sequence of Events

7.39.2.1 Ground Coolant System Installation, Launch Deck

7.39.2.1.1 Install coolant terminal box (52E180056-1) on the launch deck wall (Fig. 7-87).

7.39.2.1.2 Install two 3/8-inch hardlines (52E180065-1) for coolant along launch deck wall structure from (points* A to B). Provide for expansion and contraction using loops as required.

*In Fig. 7-87.

7.39.2.2 Ground Coolant System Installation, CVUT

7.39.2.2.1 Install two 3/8-inch hardlines, 52E180065-1, up the CVUT from (points* B and C). Provide for expansion and contraction using loops as required.

7.39.2.3 Ground Coolant System Installation (hose assemblies)

7.39.2.3.1 Install two hose assemblies , 52E180029-1, from the CVUT along boom No. 4-1/2 to the spacecraft connecting point (point* C to spacecraft).

7.39.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.39.4 Documentation

Document No.	Title
52F420123	Plumbing Routing, Complex 19, Gemini AGE, Revision F, 7 August 1962.

*In Fig. 7-87.

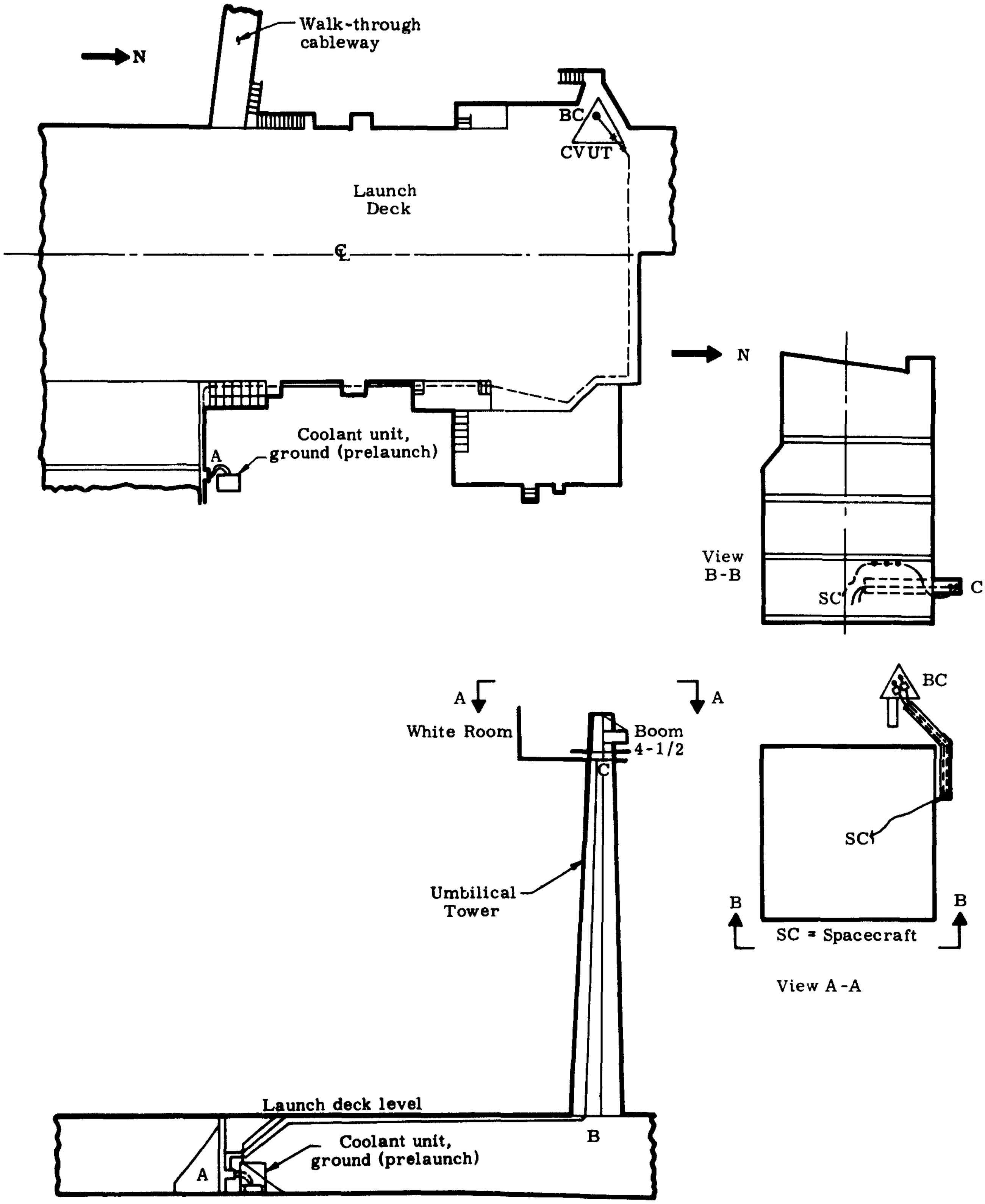


Fig. 7-87. Ground Coolant System

7.40 SPACECRAFT PROTECTIVE ENCLOSURE AIR-CONDITIONING DUCTING INSTALLATION

7.40.1 Description

Ducting conveys conditioned air from the facility air-conditioning equipment, located in a shelter on the ground approximately 200 feet south-southwest of the Complete Vehicle Umbilical Tower (CVUT), up to the appropriate level in the CVUT, and thence to the spacecraft protective enclosure. No air return ducting is required as the conditioned air is exhausted from the spacecraft protective enclosure to the atmosphere (Fig. 7-88).

7.40.2 Sequence of Events

7.40.2.1 Rigid Ducting Installation

Install 20-inch (inside diameter) rigid ducting from the air-handling unit to a point below the 93-foot 3-1/2-inch platform elevation on the CVUT (Fig. 7-88).

7.40.2.1.1 Connect ducting to the air-handling unit and install the duct to the approach ramp. Attach the duct to above ground supports.

7.40.2.1.2 Install the duct under the approach ramp and launch deck up to the base of the CVUT. Attach the duct to the structural members of the approach ramp and launch deck.

7.40.2.1.3 Install the ducting up the CVUT to a point below the platform at the 93-foot 3-1/2-inch elevation, and terminate the duct with a manual disconnect coupling.

7.40.2.1.4 Insulate all ducting and fittings with a 2-inch thickness of a cellular glass material, sealing all joints and ends. Wrap fiber glass cloth over the insulation and coat with a water-resistant sealer. Coat with another sealer which provides mechanical strength to the insulation.

7.40.2.2 Flexible Ducting Installation, CVUT Rigid Ducting to AGE/Facilities Interface

7.40.2.2.1 Install a length of 20-inch (inside diameter) flexible ducting from the manual disconnect coupling of the rigid ducting on the CVUT to the flanged AGE/facilities interface on the spacecraft protective enclosure.

7.40.2.2.2 Select a length for the flexible ducting which will minimize sagging and resistance to air flow.

7.40.2.2.3 Connect the flexible ducting to the couplings of the rigid ducting and of the AGE/facility interface, and cement the outer covers to the cuffs.

7.40.2.2.4 Coat all seams of the flexible ducting with a waterproof sealer.

7.40.2.2.5 Wrap the flexible ducting with a fiber glass flexible blanket insulation and overwrap with aluminum-colored blast tape.

7.40.2.3 Flexible Ducting Installation Between Paralleled Air-Conditioning Units

7.40.2.3.1 Install a 20-inch (inside diameter) flexible duct vibration connection between the two paralleled ground-based air-conditioning units.

7.40.2.3.2 Insulate the flexible duct vibration connection in the same manner as the rigid ducting.

7.40.3 Checkout Procedure

Delivery of conditioned air to the spacecraft protective enclosure must be sufficient to ensure both a comfortable working environment for personnel and for proper functioning of electrical and electronic equipment.

Flow of conditioned air must be sufficient to maintain the inside of the spacecraft protective enclosure at a positive static pressure differential of 0.2 inch of water (gage) with respect to ambient.

7.40.3.1 Functional Test

7.40.3.1.1 Visually check the ducting installation for compliance with the design requirements.

7.40.3.1.2 Check ducting and components for pressure, tightness and flow characteristics.

7.40.4 Documentation

Aerospace Ground Equipment Recommendation Data Number 43.

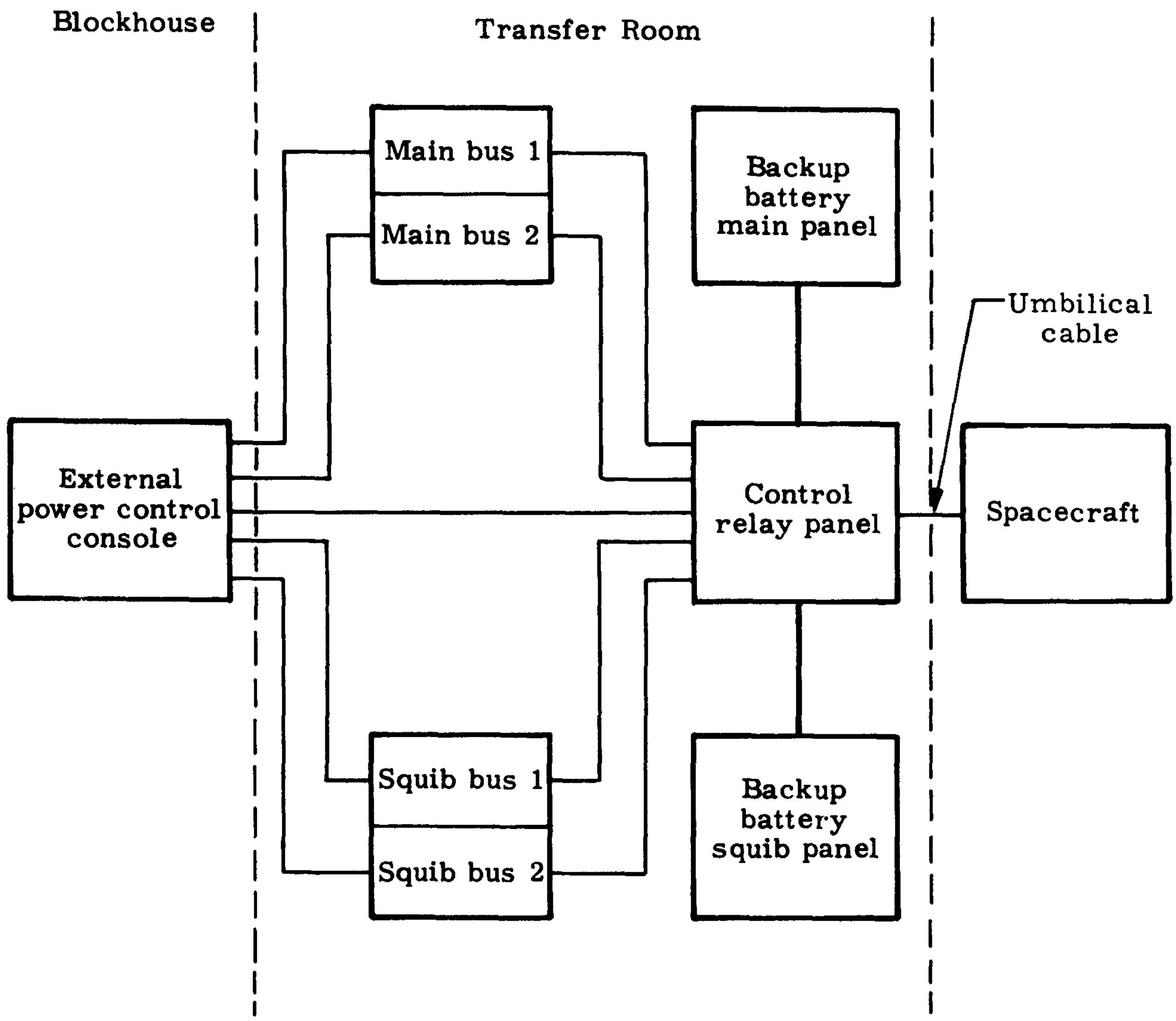


Fig. 7-88. External Power Control and Monitor

7.41 SPACECRAFT COMMUNICATION SYSTEM INSTALLATION

7.41.1 Description

The spacecraft communication system AGE consists of the following items.

Space systems communication system test station. This test station is used to monitor and evaluate the spacecraft communication system performance. It consists of signal generators, receivers, general test equipment, and special test and display panels.

AGC monitoring panel. This unit contains a meter display panel for isolating and monitoring the AGC voltage of all spacecraft receivers during the system test.

Digital command monitor. This unit consists of a receiver, decoder and readout display used for monitoring and displaying digital command data being transmitted to the spacecraft.

Digital command test set. This set consists of an FM signal generator, PCM message generator, control and display panel, and digital comparator and evaluation panels, which perform a dynamic functional test of the digital command system.

7.41.2 Sequence of Events

7.41.2.1 Communication System Installation

7.41.2.1.1 Install the six racks of the test station (52E190004-1) on the second floor of the blockhouse at Locations 25 through 30.

7.41.2.1.2 Install the AGC monitoring panel (52E190013-1).

7.41.2.1.3 Install the digital command monitor (52E190019-1).

7.41.2.1.4 Install the digital command system test set (52E190020-1).

7.41.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

7.41.4 Documentation

Documentation is unavailable at present.

7.42 SPACECRAFT SEQUENCE RECORDER SYSTEM INSTALLATION

7.42.1 Description

The Spacecraft Sequence Recorder System consists of the following items.

The Sequence Recorder System (52E230003-1), consisting of two racks in the blockhouse control room, contains three 40-channel E/A AWT-D recorders, Brush Mark 200 analog recorder, control panel, patch panel, timing panel and associated cabling. This system provides a 120-channel event recording system and an 8-channel analog recording system for the spacecraft sequential functions.

The sequential control and monitor console (52E230004-1), consisting of four racks located in the blockhouse control room, contains control and monitor panels for the abort, boost, orbit insertion, rendezvous, retrograde and recovery sequential systems. This console monitors the power available to the squib circuits and controls the latching or control relays for the spacecraft sequential system.

The external power control and monitor system (52E230005-1), consisting of one console, two racks, and a battery rack located in the blockhouse control room, provides control and monitor functions of the power supplies which furnish the power to the main and squib buses in the spacecraft. Two racks, containing four power supplies for spacecraft main buses 1 and 2, and squib buses 1 and 2, are located in the transfer room. A cabinet housing 24-volt backup batteries for the two main buses and two squib buses is located in the transfer room (Fig. 7-89).

The 36-volt d-c blockhouse power supply (52E230008-1), consisting of the power supply, control panels, monitor panel, backup battery, etc., provides 36-volt d-c power to the blockhouse spacecraft AGE control and monitor equipment.

7.42.2 Sequence of Events

7.42.2.1 Spacecraft Sequence Recorder System Installation

7.42.2.1.1 Install the two racks of the sequence recorder system (52E230003-1) in the blockhouse, in accordance with Drawing 424-2251000.

7.42.2.1.2 Install the sequential control and monitor console (52E230004-1), four racks, in the blockhouse control room, in accordance with Drawing 424-2251000.

7.42.2.1.3 Install the console, two racks and the battery rack of the external power control and monitor system (52E230005-1) in the blockhouse control room, in accordance with Drawings 424-2251000 and 424-2152400.

7.42.2.1.4 Install the 36-volt d-c blockhouse power supply in accordance with Drawing 424-2251000.

7.42.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

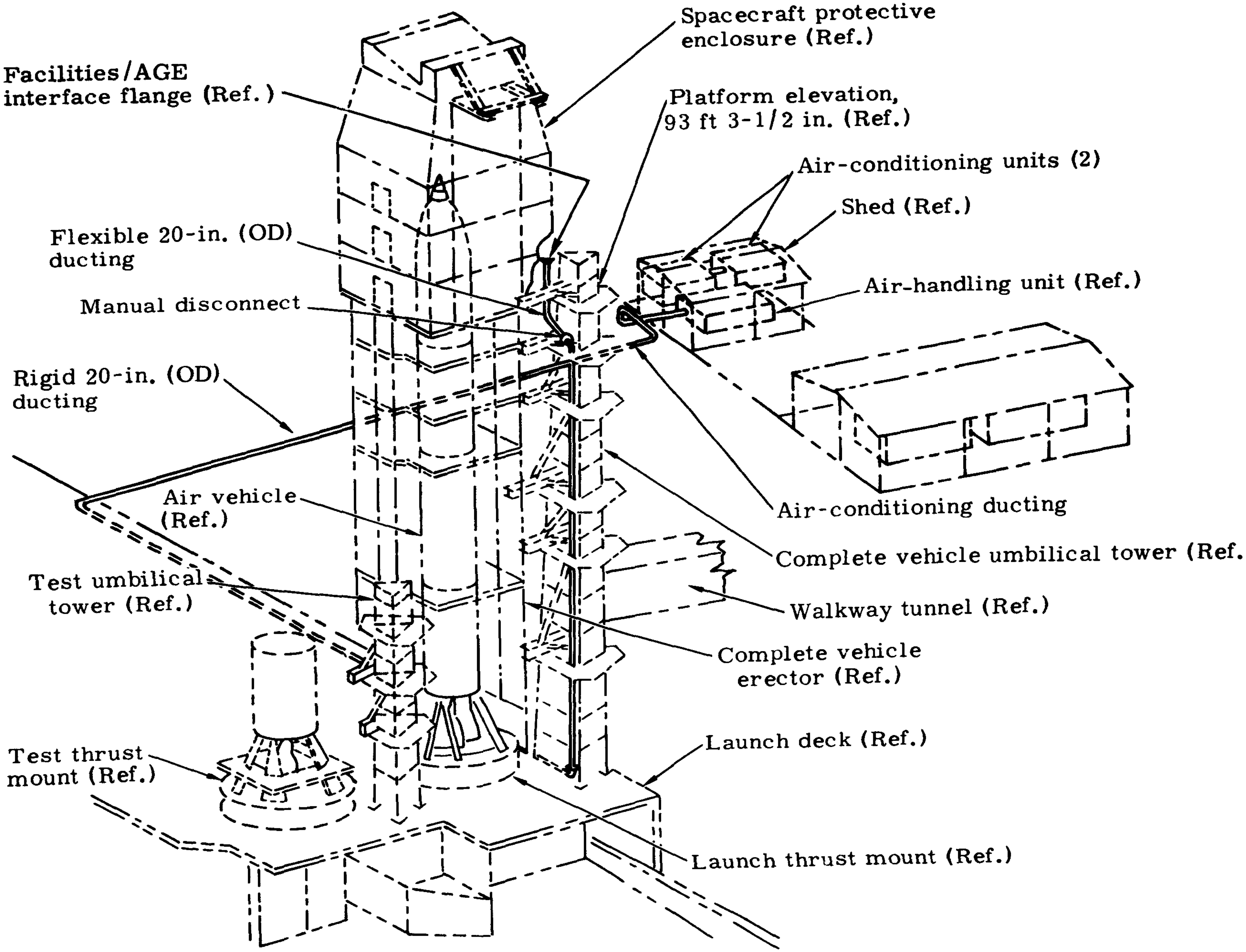


Fig. 7-89. Spacecraft Protective Enclosure Air-Conditioning Ducting

7.43 SPACECRAFT TELEVISION CAMERA AND CONTROLS INSTALLATION

7.43.1 Description

A Closed Circuit Television System, consisting of camera, control box and cables, is used for white room monitoring. Four monitors are located in the blockhouse control room (Locations 57 through 60).

7.43.2 Sequence of Events

7.43.2.1 Spacecraft Camera and Controls Installation

7.43.2.1.1 Install according to Drawing 424-2251000.

7.43.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

7.44 SPACECRAFT RADAR SYSTEM TEST CONSOLE INSTALLATION

7.44.1 Description

The Radar System Test Console (52E270024-1) is capable of monitoring and performing tests on the rendezvous radar and rendezvous radar transponder to ensure proper functional operation of the systems. The unit consists of a three-bay console containing the following chassis:

(1) Video simulator.

(2) Range and range-rate generator.

(3) Digital readout panel.

(4) RF oscillator and modulator.

(5) Receiver.

(6) Electronic digital counter.

(7) Transfer oscillator.

(8) RF power meter.

(9) Control and monitor panel.

(10) Precision ac-dc voltmeter.

(11) Oscilloscope.

(12) Test points.

(13) RF distribution.

7.44.2 Sequence of Events

7.44.2.1 Installation of Radar System Test Console

7.44.2.1.1 Install all components of the Radar System Test Unit.

7.44.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

7.45 SPACECRAFT FLIGHT CONTROL SYSTEM TEST SYSTEM INSTALLATION

7.45.1 Description

The monitor panel horizon sensor (52E270015-1) is used during system test to display pitch and roll output voltages and to indicate loss of the sensor's track condition.

7.45.2 Sequence of Events

7.45.2.1 Spacecraft Flight Control System Test Console Installation

7.45.2.1.1 Install all components of the Flight Control System Test System.

7.45.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

As part of cable installation, checks must be made to assure compliance with applicable spacecraft cable test specifications.

7.46 SPACECRAFT INERTIAL MEASURING UNIT TEST CONSOLE INSTALLATION

7.46.1 Description

The Inertial Measuring Unit (IMU) Test Console is capable of performing system testing during prelaunch checkout of the complete IMU. The IMU consists of the inertial platform, IMU electronics and IMU power supply. The tester verifies the IMU, and enables the inertial platform to be aligned to the local vertical and the expected orbital path prior to launch. The IMU test system consists of a three-bay console and three racks located in the blockhouse and one rack in the transfer room.

7.46.2 Sequence of Events

7.46.2.1 IMU Test Equipment Installation, Blockhouse

7.46.2.1.1 Install the following IMU test console equipment on the second floor of the blockhouse:

(1) Three racks containing:

(a) Guidance control panel.

(b) Alignment reference panel.

(c) Torque control panel.

(d) IGS interface simulator panel.

(e) Monitor control panel.

(f) 28-v d-c power supply panel.

(g) 400-cps power supply panel.

(h) Two-channel recorder.

(i) Electronic counters.

(j) Oscilloscope.

(k) Digital voltmeter.

(2) Three-bay console containing:

(a) Auto-monitor control panel.

The units shall be located and installed in accordance with Drawing 424-2251000, AGE Installation, Blockhouse Second Floor, Complex 19.

7.46.2.2 IMU Test Equipment Installation, Approach Ramp Building

7.46.2.2.1 Install in the transfer room on the first floor of the approach ramp building one rack containing an auto-monitor panel and the IMU buffer electronic panel.

This unit shall be installed in accordance with Drawing 424-2152400, Equipment Installation Transfer Room and Lower Equipment Room.

7.46.3 Checkout Procedure

The spacecraft AGE described is installed by the Integrating Contractor. However, the responsibility for functional checkout of the system remains with the spacecraft contractor.

7.46.4 Documentation

Document No.	Title
424-2152400	Equipment Installation, Transfer Room and Lower Equipment Room
424-2251000	AGE Installation, Blockhouse Second Floor, Complex 19.

8.0 PERSONNEL PROGRAMMING PLAN

Figure 8-1 contains the personnel programming plan for launch complex activation.

This figure presents the summation of the manpower estimates included in the various tasks described in Section 7.0, Description of AGE Subsystems Installation and Checkout.

The following estimates are not included:

(1) Manpower estimates for facility modification performed under direction of the Corps of Engineers. This information is not included because it is supplied directly to the Air Force by the Corps of Engineers.

(2) Manpower estimates for spacecraft AGE installation and checkout. This information will be added as spacecraft AGE information becomes available.

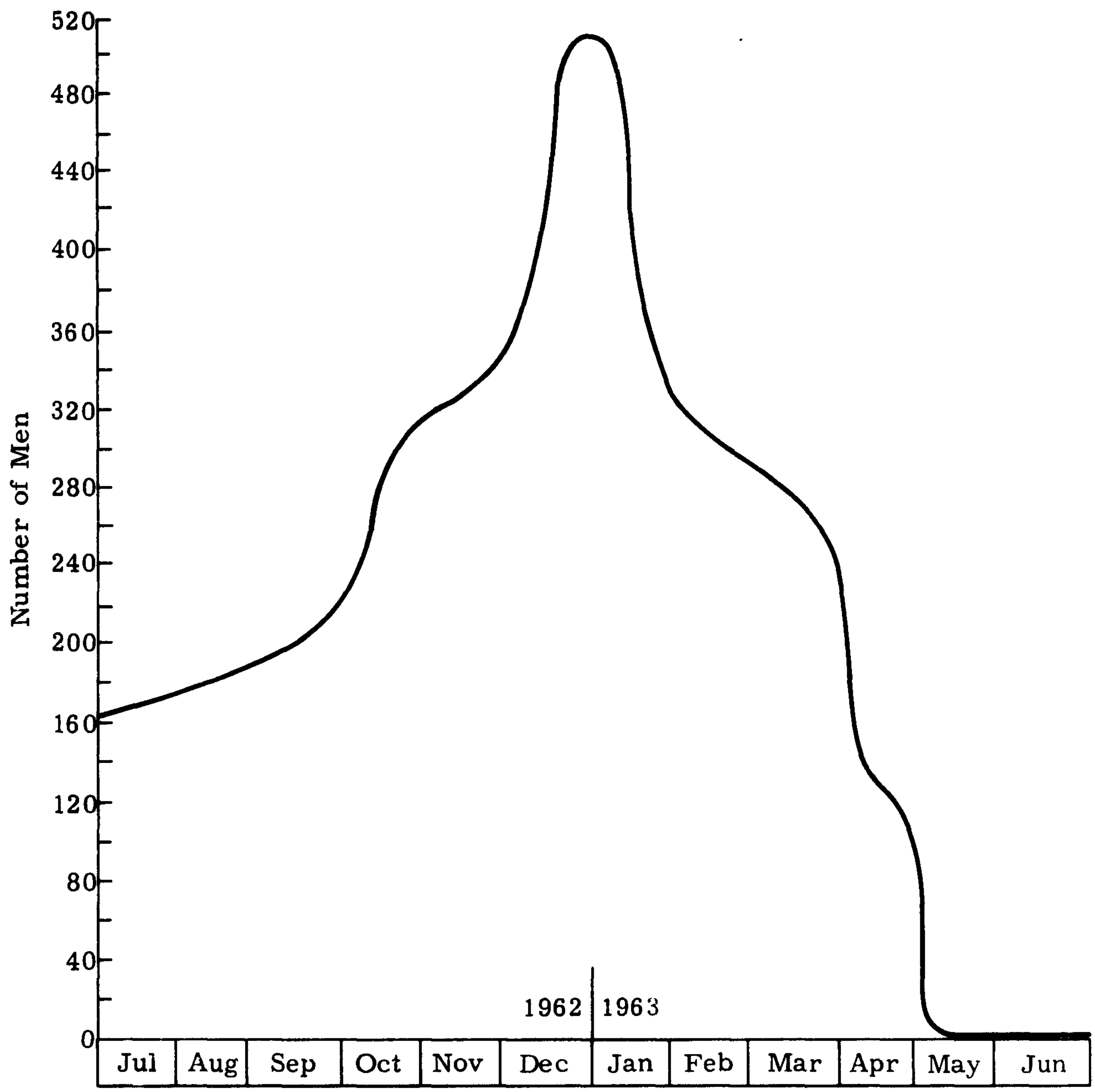


Fig. 8-1. Manpower Loading

9.0 COMPLETE AIR VEHICLE ERECTION

9.1 DESCRIPTION

This section presents a general description of the erection of the Gemini launch vehicle (Stages I and II) and the spacecraft. Integrated in the erection procedures are operational tests. These tests are mentioned only generally so that a complete sequence can be followed. The sequence starts by assuming the launch vehicle is on the launch deck and resting on the Stages I and II trailers. The sequence continues through flight readiness firing.

The information contained in this document concerning the spacecraft is current as of the publication date; however, it should be noted that some portions of the spacecraft handling equipment are still under development.

9.1.2 Sequence of Events

9.1.2.1 Stage I Erection (Fig. 9-1, Test Procedures 424-778/AMR and 424-9592009)

9.1.2.1.1 Install transits at position Nos. 1 and 2; a theodolite may be used at position No. 2.

9.1.2.1.2 Ensure that the following conditions exist:

(1) Erector is in the completely down position (horizontal).

(2) All six cylinder rods of the upper sheave block are extended.

(3) Actuator single tree is balanced and both cables have approximately equal tension.

(4) Upper and lower sheave blocks are free of all debris.

(5) Winch motor and cable tunnel are free of any obstructions.

(6) Trailer tow circuit breaker is Off.

(7) Complete erector is clear of all debris.

(8) Erector leg locks are fully open.

(9) Safety barrier chains and posts have been removed.

(10) Hand rails and platforms are folded, and the platform restraining cables are fastened.

(11) Facility nitrogen pressure is available to the erector.

(12) Nitrogen supply line manual valve is open.

9.1.2.1.3 Supply electrical power to the erector.

9.1.2.1.4 Ensure that the fail-safe system is disengaged.

9.1.2.1.5 Place the blockhouse control switch in the Off position.

9.1.2.1.6 Depress the emergency stop button and ensure that both of the fail-safe mechanisms engage.

9.1.2.1.7 Ensure that the AGE ground hydraulic unit is in operation.

9.1.2.1.8 Station a man in the actuator room to observe the actuator performance and detect any malfunction.

9.1.2.1.9 Manually open the locks holding the white room bascule roof door in place.

9.1.2.1.10 Move the white room bascule roof door mechanism and the hoist beam mechanism control to the Open position.

9.1.2.1.11 Attach the Stage I lifting spider to the forward end of the launch vehicle Stage I.

9.1.2.1.12 Attach the lateral support cable brackets to the handling ring and the longerons with the hardware provided.

9.1.2.1.13 Close the trailer tow mechanism circuit breaker on the erector near the trailer drive motor.

9.1.2.1.14 Tow the Stage I trailer into the erector.

9.1.2.1.15 Elevate the Stage I trailer and launch vehicle Stage I (using the trailer hydraulic system) to five inches above the centerline of the erector.

9.1.2.1.16 Attach the aft lateral support and wind cables to the slide carriage on the erector and longeron fitting of the launch vehicle.

9.1.2.1.17 Attach the forward lateral support and wind cables to the forward handling ring and brackets on the erector at an elevation of 66 feet 1-13/16 inches.

9.1.2.1.18 Remove the hold-down hardware from the launch vehicle Stage I and the Stage I trailer.

9.1.2.1.19 Lower the Stage I trailer bed leaving the launch vehicle suspended on the support cables.

9.1.2.1.20 Remove the Stage I trailer from the erector.

9.1.2.1.21 Remove the mobile ramp.

9.1.2.1.22 Remove the propellant tank horizontal attitude breathers from Stage I.

9.1.2.1.23 Reinstall the airborne piping to each tank dome vent opening.

9.1.2.1.24 Cover the vent umbilical couplings.

9.1.2.1.25 Close and secure the hoist beam and the white room bascule roof door.

9.1.2.1.26 Close the white room bascule roof door locks.

9.1.2.1.27 Install the safety cables between the lifting spider and the brackets in the spacecraft white room.

9.1.2.1.28 Reel out the hoist cable and attach to the lifting spider assembly.

9.1.2.1.29 If the wind is above 25 miles per hour at 10-foot elevation, install wind support cables at an elevation of 73 feet 6 inches.

9.1.2.1.30 Install the wind support cable assembly at an elevation of 80 feet 7 inches.

9.1.2.1.31 Preload all the lateral support cables that support Stage I.

(1) Attach the location indicator assembly to the lifting spider assembly and clamp the location indicator gage assembly to the trailer track.

(2) Place the location indicator gage so that the "O" on the gage is at plumb bob.

(3) Preposition Stage I by actuating the hoist to align the point of the plumb bob in the location indicator assembly with the 2-1/2-inch graduation mark on the location indicator gage.

(4) Remove and stow the location indicator gage and the location indicator assembly.

9.1.2.1.32 Instruct the hydraulic unit operator to start the primary and secondary pumps.

9.1.2.1.33 Ensure that the platform isolation valve is closed, and raise the erector to a vertical position.

NOTE: If it is necessary to stop the erector motion at any time, press the Stop button. Use the Emergency Stop button only if the Stop button does not arrest the motion of the erector.

9.1.2.1.34 When the erector reaches the full up position, ensure that both leg locks engage.

9.1.2.1.35 Replace all the safety barrier posts and chains.

9.1.2.1.36 Open the platform isolation valve.

9.1.2.1.37 Remove and stow the lateral support cables and the brackets from the erector and from the forward handling ring.

9.1.2.1.38 Adjust the aft end of Stage I onto the centerline of the erector using the turnbuckles on the lateral support cables and the wind cables. (Stage I will have to be moved approximately five inches closer to the rear of the erector.)

9.1.2.1.39 Adjust the forward wind support cable assembly to bring the forward end of Stage I onto the erector centerline.

9.1.2.1.40 Lower the folding platforms at erector elevations of 70 feet 3 inches and 60 feet 6 inches.

9.1.2.1.41 Remove the forward handling ring.

9.1.2.1.42 Raise the folding platforms at erector elevations of 70 feet 3 inches and 60 feet 6 inches.

9.1.2.1.43 If Stage I is to be left vertically suspended for an extremely long period, the lateral support cables must be reinstalled.

9.1.2.1.44 Remove the safety cables from the lifting spider and stow.

9.1.2.1.45 Lower Stage I to a position where the bottom of the lifting spider is approximately even with the folding platform at an elevation of 70 feet 3 inches.

9.1.2.1.46 If the wind is less than 25 miles per hour at 10 feet above the ground, Stage I may be lowered toward the thrust mount without further adjustments.

9.1.2.1.47 If the wind is above 25 miles per hour at 10 feet above the ground, the wind support cables at an elevation of 73 feet 6 inches are removed from the upper attachment brackets and installed to the lower brackets.

9.1.2.1.48 Lower Stage I to a position approximately six inches above the thrust mount seating.

9.1.2.1.49 If the wind permits, the turnbuckles attached to the aft end of Stage I may be loosened to permit manual positioning onto the seat of the thrust mount; however, if the wind is sufficiently heavy, turnbuckles must be used.

9.1.2.1.50 After bolting down and securing Stage I to the thrust mount with the static firing bolts, remove and stow the lifting spider assembly, the wind cables, the aft lateral support cables, and all of the bracket assemblies.

9.1.2.1.51 Install the propellant tank vertical attitude breather assemblies to Stage I.

9.1.2.1.52 Ensure that all of the work platforms are folded and their restraining cables are attached.

9.1.2.1.53 Ensure that the work elevator is at level position No. 6.

9.1.2.1.54 Ensure that the spacecraft white room elevator is at a level of 91 feet 2 inches.

9.1.2.1.55 Ensure that the erector and approach ramp are clear of all personnel and equipment.

9.1.2.1.56 Remove all the safety barrier posts and chains. (This is to be done every time the erector is to be lowered.)

9.1.2.1.57 Instruct the hydraulic unit operator to start the primary and secondary pumps.

9.1.2.1.58 Lower erector to a horizontal position.

NOTE: If it is necessary to stop the erector motion, press the Stop button. Use the Emergency Stop button only if the Stop button does not arrest the motion of the erector.

9.1.2.1.59 Open the spacecraft white room bascule roof door locks, then actuate the roof open mechanism.

9.1.2.1.60 When it becomes necessary to remove Stage I or to operate the erector, follow the reverse procedure of erection.

9.1.2.2 Stage II Erection in the CVE (Fig. 9-2, Test Procedures 424-778/AMR and 424-9592009)

9.1.2.2.1 Move the hoist beam mechanism to the Open position.

9.1.2.2.2 Position the mobile ramp so that it lines up with the spacecraft white room tracks.

9.1.2.2.3 Attach the Stage II lifting spider to the forward end.

9.1.2.2.4 Attach the forward and aft handling ring brackets with the hardware provided.

9.1.2.2.5 Tow the Stage II trailer into the erector.

9.1.2.2.6 Using the trailer hydraulic system, position the centerline of the stage to three inches above the centerline of the erector.

9.1.2.2.7 Free the sliding carriage from the slide beam.

9.1.2.2.8 Attach the aft lateral support and wind cables to the slide carriages and aft handling ring fittings (located at an elevation of 74 feet 4 inches).

9.1.2.2.9 Attach the forward lateral support and wind cables to the forward handling ring brackets and column attachment brackets.

9.1.2.2.10 Remove the hold-down hardware between the launch vehicle Stage II and the Stage II trailer.

9.1.2.2.11 Lower the Stage II trailer leaving the launch vehicle suspended on the support cables.

9.1.2.2.12 Remove the Stage II trailer from the erector.

9.1.2.2.13 Remove the mobile ramp.

9.1.2.2.14 Remove the trailer tracks from the inside of the spacecraft white room.

9.1.2.2.15 Move the hoist beam mechanism and the white room bascule roof door to the closed position.

9.1.2.2.16 Close the locks on the bascule roof door.

9.1.2.2.17 Remove the propellant tank horizontal attitude breathers from Stage II.

9.1.2.2.18 Reinstall the airborne piping to each tank dome vent opening.

9.1.2.2.19 Cover the vent umbilical couplings.

9.1.2.2.20 Attach the wind support cable assembly in the spacecraft white room at an elevation of 103 feet 3 inches.

9.1.2.2.21 Reel out the hoist cable and attach to the forward lifting spider assembly.

9.1.2.2.22 Install the safety cables between lifting spider and brackets in the spacecraft white room.

9.1.2.2.23 Preload all lateral support cables.

9.1.2.2.24 Attach the location indicator assembly to the lifting spider assembly, using a quick-release pin to secure it.

9.1.2.2.25 Attach the location indicator gage assembly to the trailer track. Place the location indicator gage so that an "O" on the gage is at plumb bob.

9.1.2.2.26 Preposition Stage II by actuating the hoist to align the point of the plumb bob in the location indicator assembly with the 1-1/2-inch graduation mark on the location indicator gage.

9.1.2.2.27 Remove and stow the location indicator gage and location indicator assembly.

9.1.2.2.28 Ensure that the erector is clear of all personnel and foreign objects.

9.1.2.2.29 Instruct hydraulic unit operator to start the primary and secondary pumps.

9.1.2.2.30 Ensure that the platform isolation valve is closed.

9.1.2.2.31 Move the erector to a vertical position.

NOTE: If it is necessary to stop the erector motion at any time, press the Stop button. Use the Emergency Stop button only if the Stop button does not arrest the motion of the erector.

9.1.2.2.32 When the erector reaches the Full Up position, ensure that both leg locks engage.

9.1.2.2.33 Replace all safety barrier posts and chains (to be done every time erector is used).

9.1.2.2.34 Open the platform isolation valve.

9.1.2.2.35 Open any required work platforms from the local control boxes.

9.1.2.2.36 Instruct the hydraulic unit operator to stop one hydraulic pump.

9.1.2.2.37 Adjust the forward wind support cables to bring the forward end of Stage II onto the erector centerline.

9.1.2.2.38 Using the turnbuckles on the aft lateral support cables, adjust the aft end of Stage II onto the centerline of the erector; movement will be approximately three inches.

9.1.2.2.39 Remove and stow the forward lateral support and wind cables from the forward handling ring and structure.

9.1.2.2.40 Disconnect and stow the safety cables from the lifting spider.

9.1.2.2.41 Lower Stage II to within six inches of the interface of Stage I.

9.1.2.2.42 If the wind permits, the turnbuckles on the aft wind and lateral support cables may be loosened to permit Stage II to be positioned manually upon the Stage I interface; however, if the wind is sufficiently heavy, turnbuckles must be used.

9.1.2.2.43 Secure Stage II to Stage I.

9.1.2.2.44 Lower the folding platform at an elevation of 91 feet 2 inches.

9.1.2.2.45 Remove the forward handling ring.

9.1.2.2.46 Raise the folding platform at an elevation of 91 feet 2 inches.

9.1.2.2.47 Install the propellant tank vertical attitude breathers to Stage II.

9.1.2.2.48 Lower the folding platforms at elevations of 70 feet 3 inches, 80 feet 8 inches and 91 feet 2 inches.

9.1.2.2.49 Remove the aft lateral support and wind cables.

9.1.2.2.50 Remove the aft handling ring.

9.1.2.2.51 Remove the forward wind support cables and lifting spider assembly.

9.1.2.2.52 Retract the hoist into the erector and secure.

9.1.2.2.53 To remove Stage II from Stage I, follow this procedure in reverse.

9.1.2.2.54 The operational procedure for the erector is the same every time the erector is raised or lowered.

9.1.2.3 Launch Vehicle Alignment

9.1.2.3.1 Position a theodolite or a transit in the theodolite building, and one transit on the launch deck surveyors track, or a convenient location for vertical sighting of the launch vehicle in the pitch axis.

9.1.2.3.2 Use the launch vehicle skin line to determine the vertical alignment in the pitch and yaw axes, since there are no targets displayed on the launch vehicle.

9.1.2.3.3 Ensure that the pitch and yaw vertical alignment of the launch vehicle is within 3/8 inch.

9.1.2.3.4 If the vertical alignment deviation is greater than 3/8 inch, adjust the thrust mount attachment head expendable sleeves to correct the error.

9.1.2.3.5 Ensure that the launch vehicle is along a given azimuth within a tolerance of ±0.025 degree. Use the black and white paint patterns for launch vehicle reference, which is to be correlated with the thrust mount.

9.1.2.4 Spacecraft Erection and Work Platform Fit Checks (Fig. 9-3 and Test Procedure 424-787/AMR)

9.1.2.4.1 Position the spacecraft transporting vehicle upon the access road unloading marks.

9.1.2.4.2 Attach the transfer crane handling sling to the spacecraft.

9.1.2.4.3 Attach the spacecraft adapter ring on the bottom of the spacecraft to facilitate positioning inside the white room.

9.1.2.4.4 Remove the spacecraft hold-down attachments on the transporting vehicle.

9.1.2.4.5 Actuate the transfer crane to hoist the spacecraft onto the launch deck.

9.1.2.4.6 Position the spacecraft on the launch deck erection platform.

9.1.2.4.7 Disconnect the transfer crane handling sling from the spacecraft.

9.1.2.4.8	Attach the hoisting crane sling to the spacecraft.
9.1.2.4.9	Raise the spacecraft white room rolling door located on the north side of the enclosure.
9.1.2.4.10	Move the hoist out to the end of the crane tracks.
9.1.2.4.11	Unreel the hoisting crane cable and attach the hook to the spacecraft hoisting crane sling.
9.1.2.4.12	Attach the stabilizing lines to the spacecraft and to the hoisting crane sling.
9.1.2.4.13	Actuate the hoisting crane to lift the spacecraft into the spacecraft white room.
9.1.2.4.14	Remove the spacecraft stabilizing lines as soon as the spacecraft is inside the white room.
9.1.2.4.15	Unfold the folding platform in the white room at an elevation of 100 feet 2 inches.
9.1.2.4.16	Install the three spacecraft support brackets on the unfolded platform.
9.1.2.4.17	Close the white room rolling door and lock.
9.1.2.4.18	Lower the spacecraft onto the spacecraft support brackets and secure.
9.1.2.4.19	Unfold all the folding platforms and ensure that they fit properly.
9.1.2.4.20	Connect the air-conditioning ducting from the umbilical tower to the spacecraft white room.
9.1.2.4.21	Connect the electrical cable assemblies from the umbilical tower to the spacecraft (approximately nine cables).
9.1.2.4.22	Ensure that the spacecraft white room temperature and filtering requirements are met after installation of all the umbilical connections.
9.1.2.4.23	Obtain the Reaction Control System dolly and the portable spacecraft work platform from the launch deck; then transport them via the spacecraft elevator to an elevation of 109 feet and 91 feet, respectively.

9.1.2.4.24 Install the spacecraft portable work platform on top of the launch vehicle Stage II at an elevation of 91 feet in the erector.

9.1.2.4.25 Install the spacecraft recovery and rendezvous module (R and R module) hoisting attachment to the spacecraft.

9.1.2.4.26 Disconnect the R and R module from the spacecraft and lift the section onto the Reaction Control System dolly located at an elevation of 109 feet.

9.1.2.4.27 Perform preliminary spacecraft subsystems tests.

9.1.2.4.28 Reinstall the R and R module onto the spacecraft in the reverse order of the preceding procedure.

9.1.2.4.29 Install the spacecraft hoisting crane sling.

9.1.2.4.30 Remove the portable spacecraft work platform at an erector elevation of 91 feet; then transport and stow the work platform and the Reaction Control System dolly to the launch deck.

9.1.2.4.31 Disconnect the spacecraft from the spacecraft support brackets.

9.1.2.4.32 Raise the spacecraft far enough to remove the spacecraft support brackets and to fold the folding platform at 100 feet 2 inches.

9.1.2.4.33 Remove the spacecraft adapter ring. Ensure that there are no obstructions below the spacecraft prior to lowering the spacecraft onto Stage II.

9.1.2.4.34 Lower and secure the spacecraft onto Stage II.

9.1.2.4.35 Install the connecting platform between the umbilical tower and the spacecraft white room.

9.1.2.4.36 Unfold the folding platforms and install the removable platforms; then verify fit.

9.1.2.4.37 Connect and verify fit of the following piping from the umbilical tower extended platform to the spacecraft: three fuel fill and vent lines, two liquid oxygen fill and vent lines, one low pressure nitrogen line, one helium line, two gaseous oxygen lines, two hydrogen lines, three oxidizer fill and vent lines, two high pressure nitrogen lines, and one oxygen purge line which runs from the launch deck directly to the spacecraft white room.

9.1.2.4.38 Connect and verify fit of the electrical cable assemblies from the umbilical tower to the spacecraft.

9.1.2.5 Launch Vehicle Components Installation

9.1.2.5.1 Install air scoops on the bottom of Stage I.

9.1.2.5.2 Install the instrumentation power system, accessory power system, and destruct system batteries.

9.1.2.5.3 Install the inert gas pressure cartridges in the explosive bolts between stages.

9.1.2.5.4 Install the inert bidirectional destruct charge.

9.1.2.5.5 Install the inert destruct initiator.

9.1.2.5.6 Install the primer simulator for the inert initiator. (The stray voltage detector may be used at this time if the test sequence so instructs.)

9.1.2.5.7 Install the range safety receiver-transmitter.

9.1.2.5.8 Install the range safety command receiver.

9.1.2.6 Umbilical Connections to the Launch Vehicle (Portable Hydraulic Unit

9.1.2.6.1 Obtain the portable hydraulic unit from the lower equipment room and transport to the launch vehicle.

9.1.2.6.2 Remove the dust covers from the launch vehicle and the portable hydraulic unit connectors.

9.1.2.6.3 Connect the hydraulic hoses between the portable hydraulic unit and the launch vehicle Stage I. (Repeat procedure for Stage II after relocating hydraulic unit.)

9.1.2.6.4 Remove and stow the unit in the lower equipment room after the tests are completed.

9.1.2.7 Fuel and Oxidizer System

9.1.2.7.1 Disconnect the fuel fill and drain hoses from their jumper connections and connect to the Stages I and II umbilical connections.

9.1.2.7.2 Disconnect the fuel topping and vent hoses from their jumper connections and connect to the Stages I and II umbilical connections.

9.1.2.7.3 Disconnect the oxidizer fill and drain hoses from their oxidizer jumper connections and connect to the Stages I and II umbilical connections.

9.1.2.7.4 Disconnect the oxidizer topping and vent hoses from their oxidizer jumper connections and connect to the Stages I and II umbilical connections.

9.1.2.7.5 Obtain two pump seal drain slip-on hoses from the launch deck and connect to the pump seal drain connections on the Stages I and II umbilical connections.

9.1.2.7.6 Obtain six pump seal drain slip-on hoses from the launch deck and connect to the pump seal drain connections on the Stages I and II umbilical connections.

9.1.2.8 Air-Conditioning System Umbilical Connections

9.1.2.8.1 Connect the two launch vehicle air-conditioning flexible ducts from the umbilical tower to the Stage II umbilical connections.

9.1.2.9 Electrical Umbilical Cable Connections

9.1.2.9.1 Connect the five electrical cable assemblies from the umbilical tower to the Stages I and II umbilical connections.

9.1.2.9.2 Connect the two pad separation electrical cable assemblies to the Stage I umbilical connections.

9.1.2.10 Perform Preliminary Launch Vehicle Subsystems Tests

9.1.2.10 Removal of Stage II and spacecraft from the complete vehicle erector.

9.1.2.10.1 Remove the umbilical cables from the spacecraft, the spacecraft white room and the launch vehicle.

9.1.2.10.3 Remove the launch vehicle components from Stage II.

9.1.2.10.4 Remove the spacecraft from Stage II in the reverse of the preceding procedures except that the spacecraft does not have to stop at the 100-foot level.

9.1.2.10.5 Remove the launch vehicle Stage II from Stage I in the reverse order of the preceding procedure; then reraise the erector.

9.1.2.10.6 Install the safety nets on the erector above Stage I.

9.1.2.10.7 Place Stage II on the Stage II trailer.

9.1.2.10.8 Remove the interstage section from Stage II using the interstage dolly.

9.1.2.12 Stage II Erection on Test Thrust Mount (Fig. 9-4, Test Procedures 424-785/AMR and 424-9592009)

9.1.2.12.1 Move the hoist beam mechanism and roof mechanism to the Open position.

9.1.2.12.2 Position the mobile ramp so that it lines up with the test stand erector tracks.

9.1.2.12.3 Attach forward lifting spider.

9.1.2.12.4 Attach the primary aft and secondary aft handling ring brackets with the hardware provided.

9.1.2.12.5 Attach the forward handling ring brackets.

9.1.2.12.6 Tow the Stage II trailer into the erector.

9.1.2.12.7 Using the Stage II trailer hydraulic system, elevate the trailer and Stage II to a position three inches above the centerline of the erector.

9.1.2.12.8 Free the slide carriages from the slide beam.

9.1.2.12.9 Attach the aft lateral support and wind cables to the sliding carriages and aft handling ring fittings.

9.1.2.12.10 Attach the forward lateral support and wind cables to the forward handling ring brackets and column attachments on the test position erector.

9.1.2.12.11 Remove the hold-down hardware between the Stage and the trailer.

9.1.2.12.12 Lower the trailer leaving the launch vehicle suspended on the support cables.

9.1.2.12.13 Remove the trailer from the erector.

9.1.2.12.14 Remove the mobile ramp.

9.1.2.12.15 Move the hoist beam and roof mechanisms to the Closed position.

9.1.2.12.16 Attach the forward wind support assembly and vertical hoist extension cable.

9.1.2.12.17 Preload all lateral support cables.

9.1.2.12.18 Attach the location indicator assembly to the lifting spider assembly.

9.1.2.12.19 Attach the location indicator gage assembly to the trailer track. Place the location indicator gage so that an "O" on the gage is at plumb bob.

9.1.2.12.20 Preposition Stage II by actuating the hoist to align the point of the plumb bob in the location indicator assembly with the 1-1/2-inch graduation mark on the location indicator gage.

9.1.2.12.21 Remove and stow the location indicator gage and location indicator assembly.

9.1.2.12.22 Install the two safety support cables between the lifting spider and the top of the test position erector.

9.1.2.12.23 Ensure that the erector is clear of all personnel and foreign objects.

9.1.2.12.24 Instruct the hydraulic unit operator to start the primary and secondary pumps.

9.1.2.12.25 Ensure that the platform isolation valve is closed.

9.1.2.12.26 Raise the erector.

If it is necessary to stop the erector motion at any time, press the Stop button. Use the Emergency Stop button only if the Stop button does not arrest the motion of the erector.

9.1.2.12.27 When the erector reaches the Full Up position, ensure that both leg locks engage.

9.1.2.12.28 Replace all safety barrier posts and chains.

9.1.2.12.29 Open the platform isolation valve.

9.1.2.12.30 Instruct the hydraulic unit operator to stop one hydraulic pump.

9.1.2.12.31 Adjust the forward wind support cables to bring the forward end of the stage onto the erector centerline.

9.1.2.12.32 Using the turnbuckles on the aft lateral support cables, adjust the aft end of Stage II onto the centerline of the erector.

9.1.2.12.33 Remove and stow the forward lateral support and wind cables from the forward handling ring and structure.

9.1.2.12.34 Disconnect and stow the safety cables from the lifting spider.

9.1.2.12.35 Lower Stage II to within six inches of the thrust mount.

9.1.2.12.36 If the wind permits, the turnbuckles on the aft wind and lateral support cables may be loosened to permit Stage II to be positioned manually upon the thrust mount; however, if the wind is sufficiently great, turnbuckles must be used.

9.1.2.12.37 Lower and secure Stage II to the thrust mount.

9.1.2.12.38 Lower the folding platforms at erector elevations of 8 feet 5 inches and 30 feet 5 inches.

9.1.2.12.39 Remove the forward handling ring.

9.1.2.12.40 Remove the aft lateral support and wind cables.

9.1.2.12.41 Remove the aft handling ring.

9.1.2.12.42 Remove the adapter from the apex of the lifting spider, and lift to the level of the forward wind support cables (using the crane hoist).

9.1.2.12.43 Unfold all the folding platforms and fit check.

9.1.2.12.44 To remove Stage II from the thrust mount, follow the preceding procedure in reverse.

9.1.2.13 Stage II Umbilical Connections

9.1.2.13.1 Disconnect the fuel fill and drain hoses from their fuel jumper connections, and connect to the Stage II umbilical connections.

9.1.2.13.2 Disconnect the oxidizer fill and drain hoses from their oxidizer jumper connections, and connect to the Stage II umbilical connections.

9.1.2.13.3 Disconnect the fuel topping and vent hoses from their fuel jumper connections, and connect to the Stage II umbilical connections.

9.1.2.13.4 Disconnect the oxidizer topping and vent hoses from their oxidizer jumper connections, and connect to the Stage II umbilical connections.

9.1.2.13.5 Obtain three pump seal drain slip-on hoses from the launch deck and connect to the pump drain seal connections on the Stage II umbilical connections.

9.1.2.13.6 Connect the air-conditioning flexible duct to the umbilical connections.

9.1.2.13.7 Connect the electrical cable assemblies from the umbilical tower booms to the Stage II umbilical connections.

9.1.2.13.8 Install launch vehicle Stage II components.

9.1.2.13.9 Install the Stages I and II gas generator start assemblies.

9.1.2.13.10 Perform and verify sequented compatibility firing tests.

9.1.2.14 Stage II-Spacecraft Marriage and Prelaunch Tests on Launch Thrust Mount

9.1.2.14.1 Remove the umbilical connections from the launch vehicle Stage II.

9.1.2.14.2 Remove the launch vehicle Stage II components.

9.1.2.14.3 Remove Stage II from the vertical position in the reverse order of the preceding procedure.

9.1.2.14.4 Install the ablative skirt on the Stage II engine.

9.1.2.14.5 Using the interstage dolly, reinstall the interstage to Stage II.

9.1.2.14.6 Install Stage II on Stage I in accordance with the preceding procedures.

9.1.2.14.7 Install the launch vehicle Stage II components.

9.1.2.14.8 Install the Stage II umbilical connections.

9.1.2.14.9 Install and secure the spacecraft on the spacecraft support brackets.

9.1.2.14.10 Close the white room rolling door and install the umbilical connections to the spacecraft in accordance with the preceding procedures.

9.1.2.14.11 Perform spacecraft systems tests.

9.1.2.14.12 Connect the two electrical cable assemblies between the Stage II connections and the spacecraft.

9.1.2.14.13 Perform launch vehicle and spacecraft combined systems tests.

9.1.2.14.14 Disconnect the spacecraft umbilical cables.

9.1.2.14.15 Remove the spacecraft work platform.

9.1.2.14.16 Reinstall the R and R module upon the spacecraft.

9.1.2.14.17 Mate the spacecraft with Stage II.

9.1.2.14.18 Connect the spacecraft umbilical piping from the umbilical tower to the spacecraft.

9.1.2.14.19 Install the flyaway lanyards between the umbilical tower and the umbilical flyaway connections.

9.1.2.14.20 Perform radio frequency interference tests.

9.1.2.14.21 Perform simulated launch countdown.

9.1.2.14.22 Perform flight readiness firing tests.

The Gemini air vehicle is now ready for acceptance by the launch crew for launch preparations.

9.1.3 Documentation

Document No.	Title
Test Procedure 424-778/AMR	Complete Launch Vehicle Erection, Installation and Removal
Test Procedure 424-785/AMR	Stage II Erection, Installation and Removal
Test Procedure 424-787/AMR	Spacecraft Erection, Installation and Removal
52E250005	Support Assembly, Erector, Spacecraft
52F010199 (Sheet 2) Rev C	Gemini Spacecraft White Room Relationship
52F200101 (Sheet 1) Rev D	Cable Routing, Complex 19, Gemini AGE
52F420123 (Sheets 1 and 2) Rev F	Plumbing Routing, Complex 19, Gemini AGE
424-9592009	Operating Procedure, Erector Structure, Launch Vehicle
424-9592000	Stabilizing Lines, Complete Launch Vehicle and Second-Stage Erector
424-9592011	Stabilizing Lines, Stage I
424-9592012	Stabilizing Lines, Stage II
LV-35	Handling and Transportation
LV-38	Erector and Umbilical Tower OGE

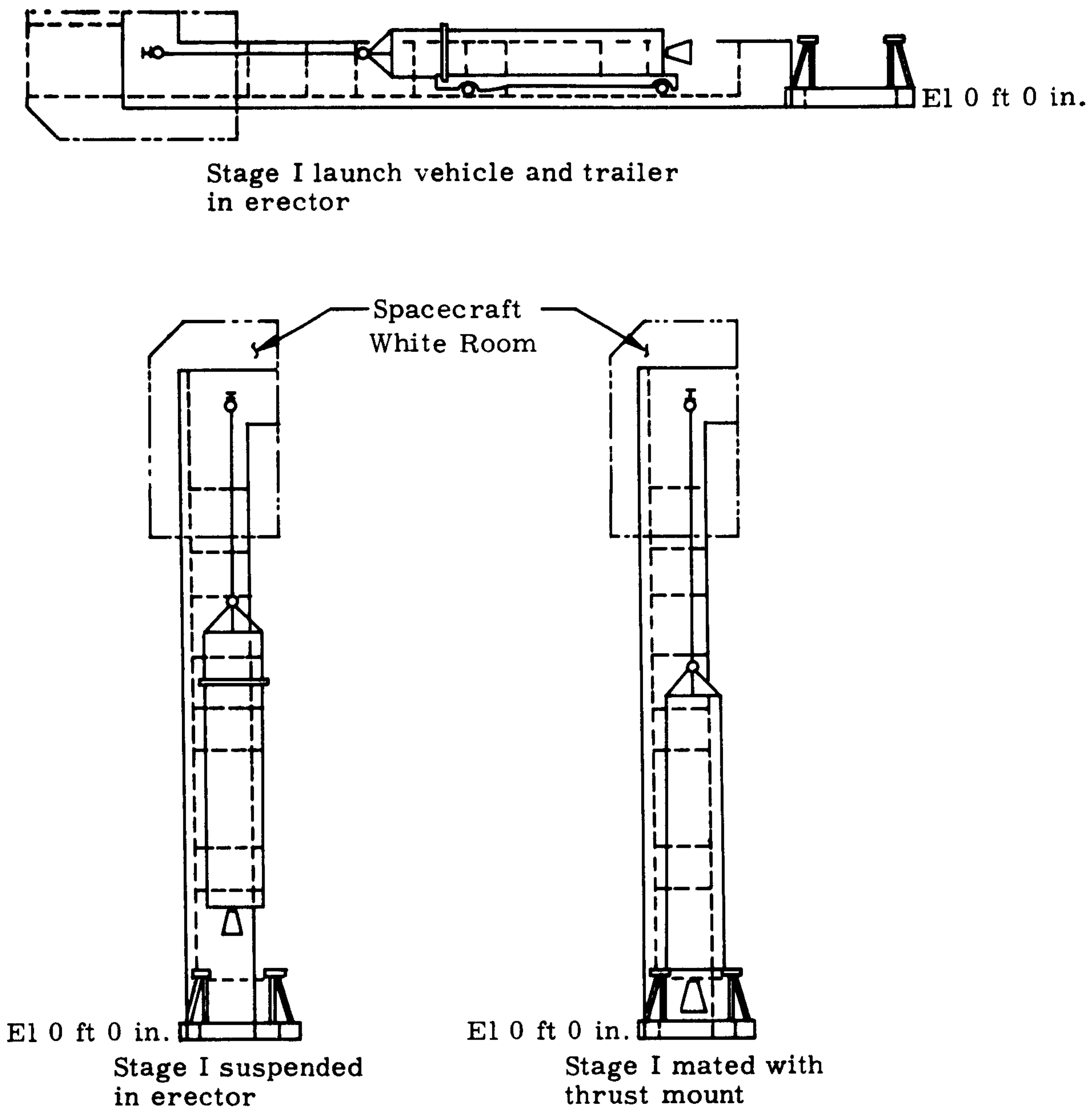


Fig. 9-1. Erection of Stage I in Launch Position

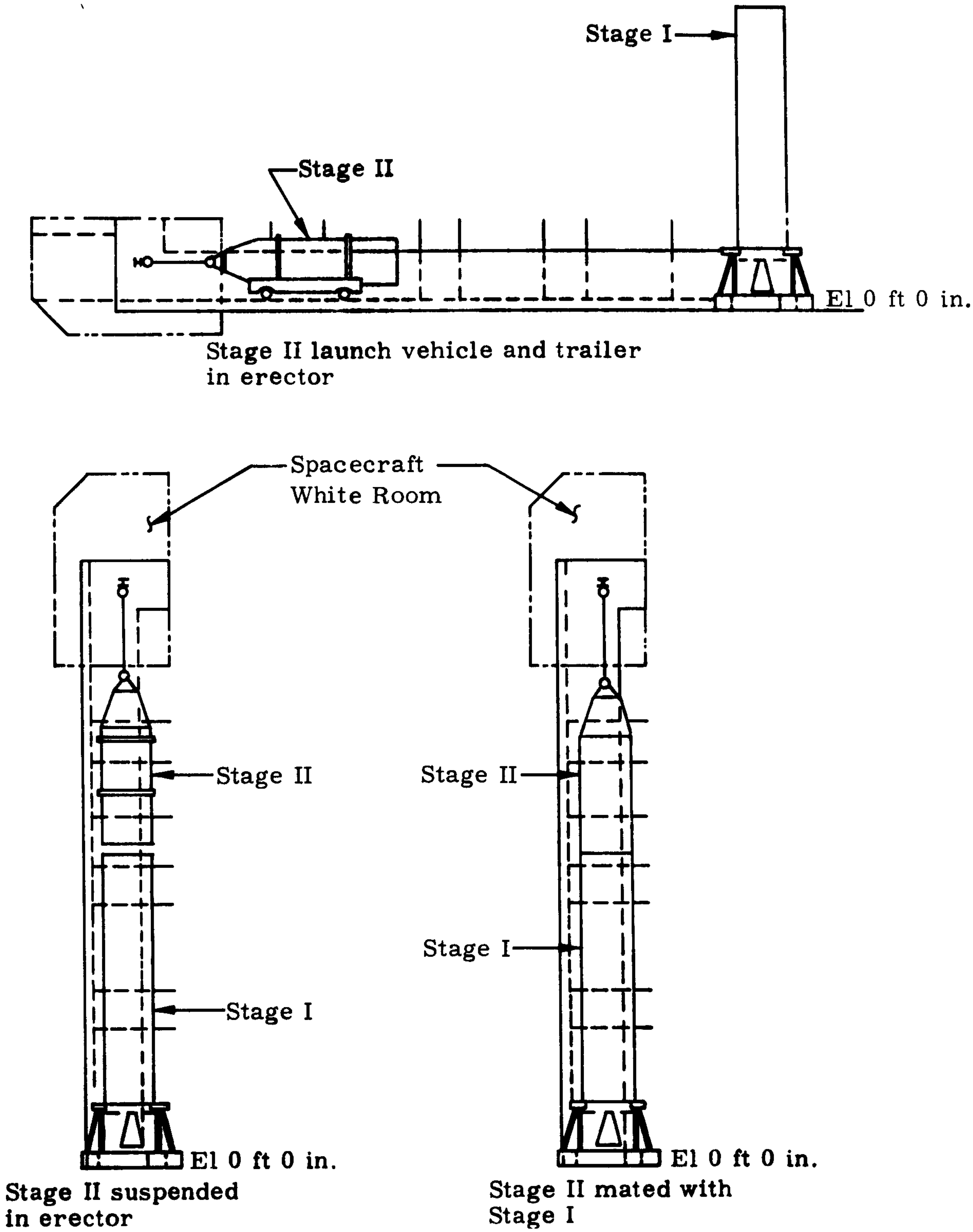


Fig. 9-2. Erection of Stage II in Launch Position

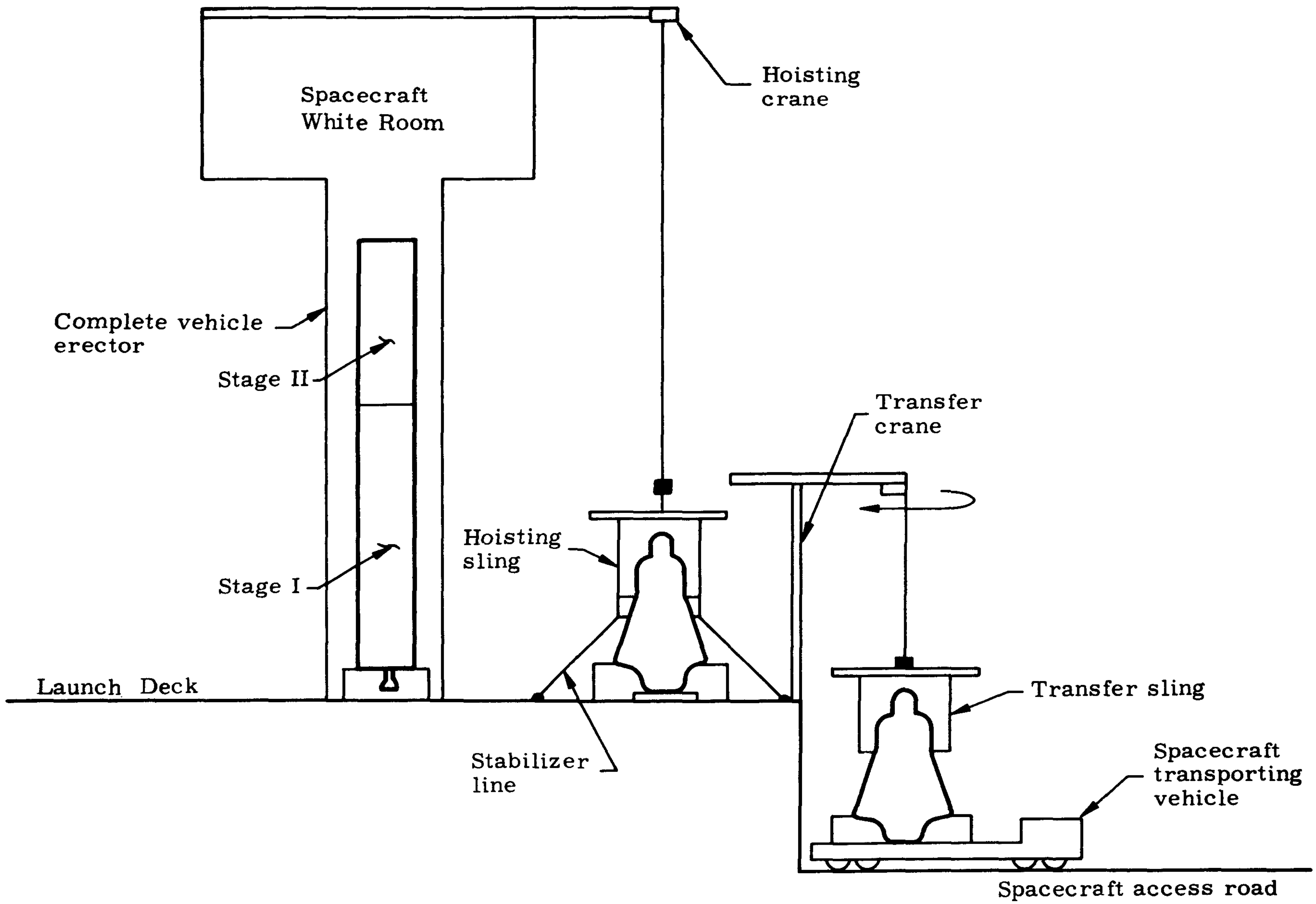
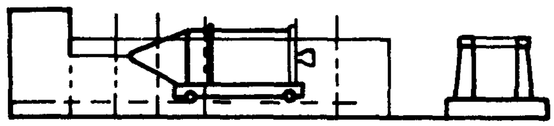
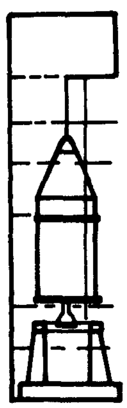
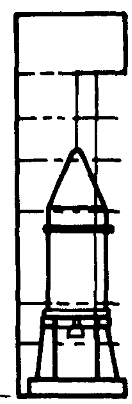


Fig. 9-3. Erection of Spacecraft



Stage II in horizontal position





Stage II before lowering to thrust mount

Stage II on thrust mount

Fig. 9-4. Erection of Stage II on Test Stand

10.0 LAUNCH COMPLEX VERIFICATION

Verification of the launch complex facility and the AGE subsystems is accomplished by inspection, ground integration tests, verification firing tests (VFT), sequential compatibility firing (SCF) and flight readiness firing (FRF).

10.1 GROUND INTEGRATION TESTS

Ground integration tests consist of a mechanical fit check, a preliminary power-on check, preliminary launch vehicle subsystems checks and a propellant flow check.

Major objectives of the ground integration tests are:

(1) Verify proper fit of launch vehicle and complex facilities.

(2) Verify proper fit of Stages I and II and spacecraft.

(3) Verify electrical compatibility.

(4) Perform preliminary checks of compatibility between vehicle subsystems and AGE subsystems.

(5) Demonstration of operation of propellant transfer and pressurization system.

10.2 VERIFICATION FIRING TESTS

Verification firing tests are performed with Stage II in the test position. These verification firing tests consist of restrained firings of individual stages in their respective test positions and allow for verification of all launch vehicle airborne subsystems in a firing environment. Also, the compatible operation of all elements of the launch vehicle during a countdown and firing can be verified.

10.3 SEQUENTIAL COMPATIBILITY FIRING (SCF)

The SCF verifies the performance of launch vehicle subsystems, AGE and facilities, and confirms readiness for launch configuration testing.

10.4 FLIGHT READINESS FIRING (FRF)

During FRF, compatibility between the operation of the total Gemini vehicle and support systems is verified. All subsystems will be exercised to simulate launch conditions as nearly as possible.

Successful completion of FRF and the various preceding steps demonstrate the capability of the complex to support Gemini launch operations. Activation of Launch Complex 19 is complete with the successful completion of the flight readiness firing.

10.5 REVISIONS TO LAUNCH COMPLEX VERIFICATION

The tests described in the preceding four paragraphs represent current planning relative to launch complex verification. Discussions are currently in progress between the Integrating Contractor and the procuring agency to define the launch complex verification. The text of Section 10 will be revised subsequently to reflect the final agreement.

10.6 TEST DOCUMENTATION

Details of the various test operations are contained in the following documents:

Document No.	Title
MB-1042	Launch Vehicle System Test Specification
MB-1049	Launch Vehicle Acceptance Test Specification
ER 12327	Gemini Launch Vehicle Test Program Plan
LV-16	Launch Vehicle System Test Specification (AMR)
424-1430002	Launch Vehicle Checkout and Test Specification
MCG-1004	Facilities AGE Acceptance Test Plan

11.0 ACCEPTANCE OF COMPLEX BY AIR FORCE

Acceptance of Launch Complex 19 by the Air Force from the Martin Company, acting as Activation Integrator, will occur after the following events have been satisfactorily completed.

(1) Removal of all existing AGE and facility items not required for the Gemini program from Complex 19.

(2) Installation of all AGE.

(3) Performance of tests outlined in the test procedures on individual items of AGE furnished by Martin.

(4) Informal checkout of AGE systems furnished by Martin.

(5) Formal performance of the tests outlined in the Ground Systems Test Procedures for AGE systems furnished by Martin.

(6) Performance of tests which indicate the adequacy of the launch complex.

In accordance with the overall plan, the following events must also occur before Martin can perform Item (6).

(1) Modification of the launch complex facility.

(2) Formal performance of tests outlined in the Ground System Test Procedures for AGE systems furnished by the spacecraft contractor

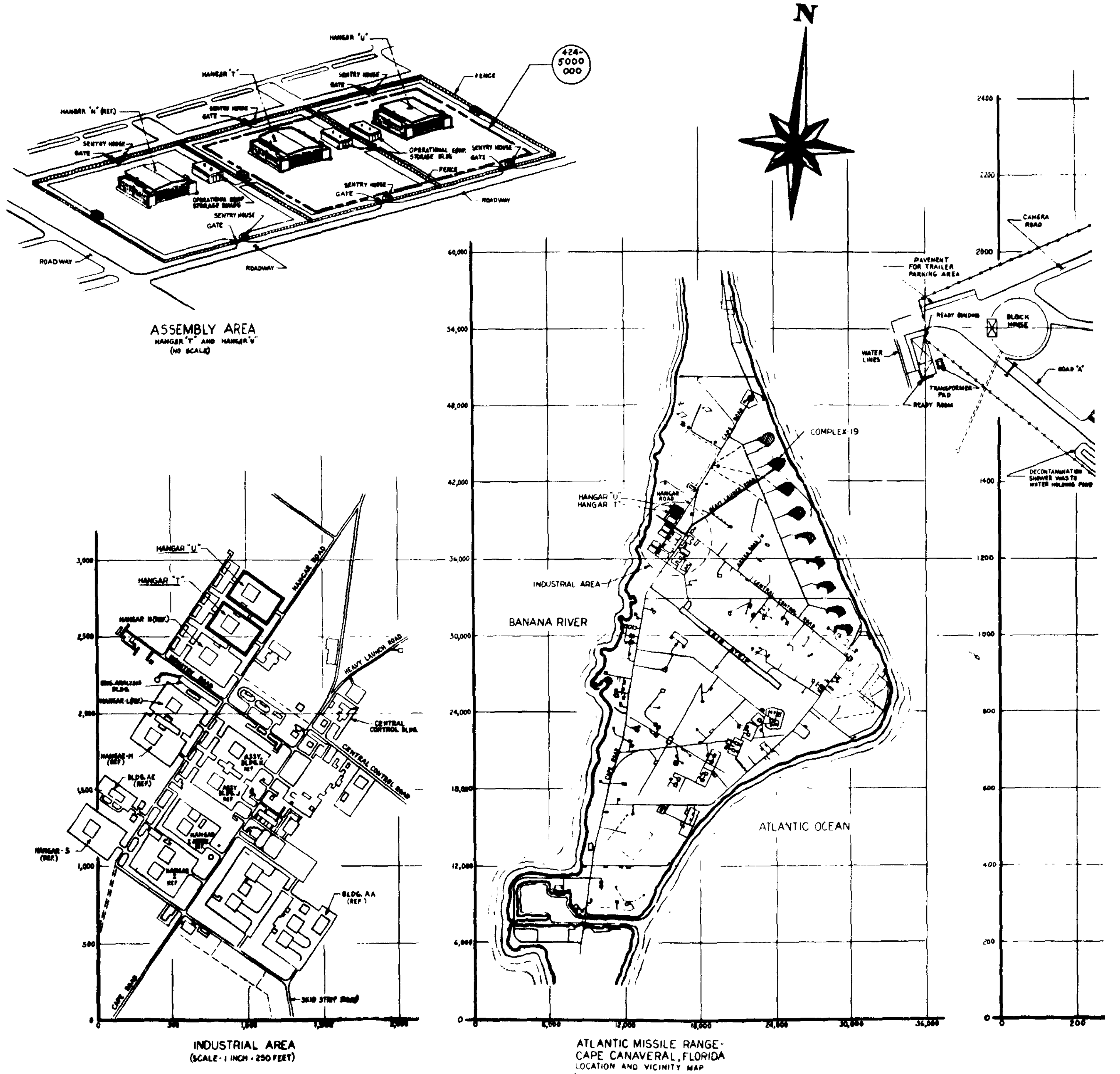
These two operations, which are not subject to Martin direction, must be coordinated by the Air Force in accordance with the overall activation plan.

The five operations which are first defined will be performed under Martin and Air Force Quality Assurance surveillance, and a complete documentation of the efforts will be provided by Martin as evidence that all applicable requirements have been met. This documentation will be available to the Air Force, as required, during the activation period.

The formal presentation of documentation will occur at a meeting attended by the Air Force and all other affected agencies after activation is considered complete. Martin will present certified documentation establishing that the portion of the effort for which it is responsible has been performed in accordance with requirements. Review and acceptance of this documentation by the Air Force will constitute acceptance of the Martin effort as Integrating Contractor.

12.0 TOPOGRAPHIC ILLUSTRATION OF FACILITIES

The location and topographical features of Complex 19 are shown in Figs. 12-1 and 12-2. Figure 12-1 illustrates the location of Complex 19 at Cape Canaveral. The Complex 19 features and the associated AGE installation are shown in Fig. 12-2.



ASSEMBLY AREA
HANGAR 'T' AND HANGAR 'U'
(NO SCALE)
INDUSTRIAL AREA
(SCALE - 1 INCH = 250 FEET)
ATLANTIC MISSILE RANGE-
CAPE CANAVERAL, FLORIDA
LOCATION AND VICINITY MAP
(SCALE 1 INCH = 3,000 FEET)
BANANA RIVER
ATLANTIC OCEAN
COMPLEX 19
INDUSTRIAL AREA
HANGAR 'U'
HANGAR 'T'

Fig. 12-1. C

2

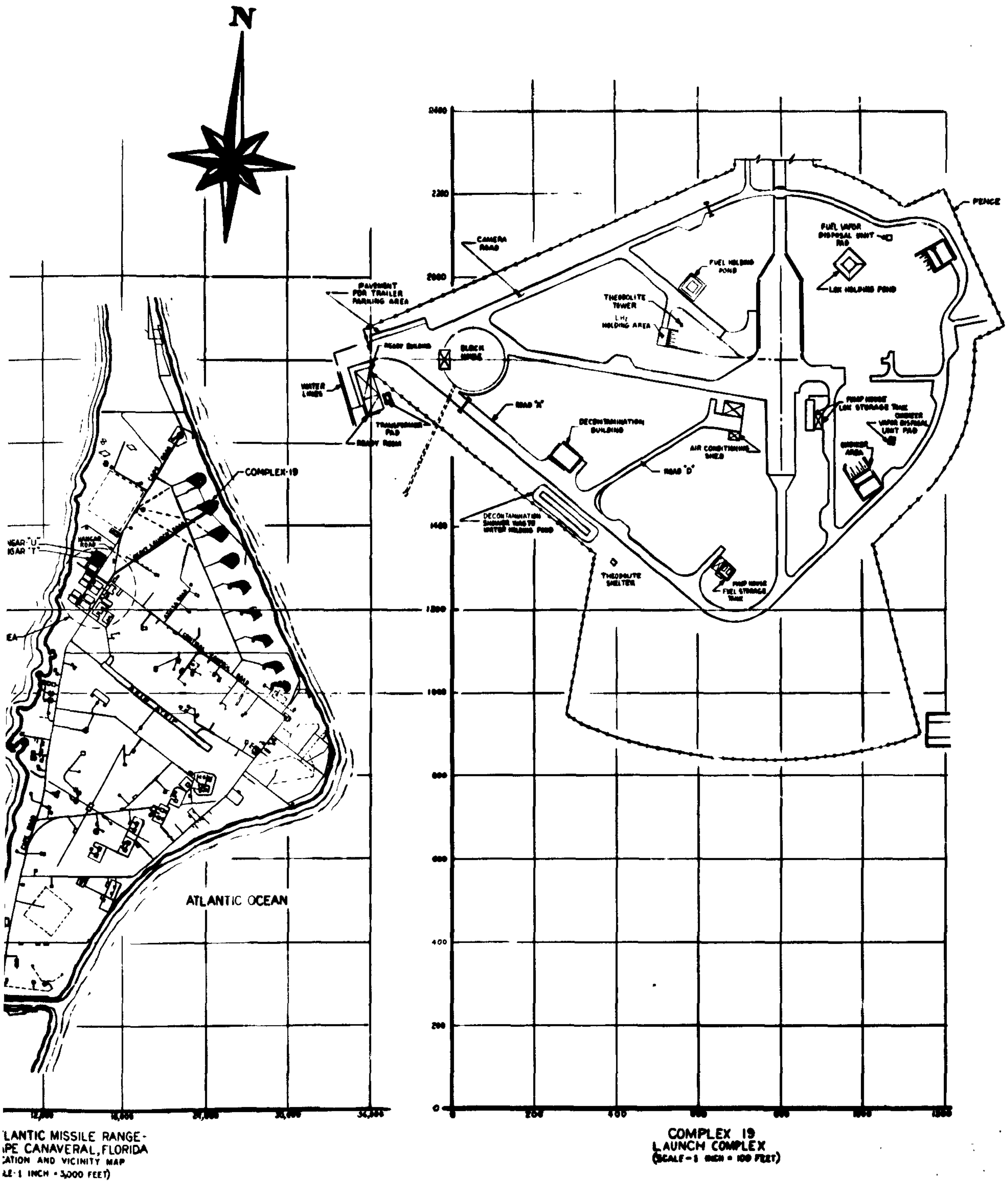
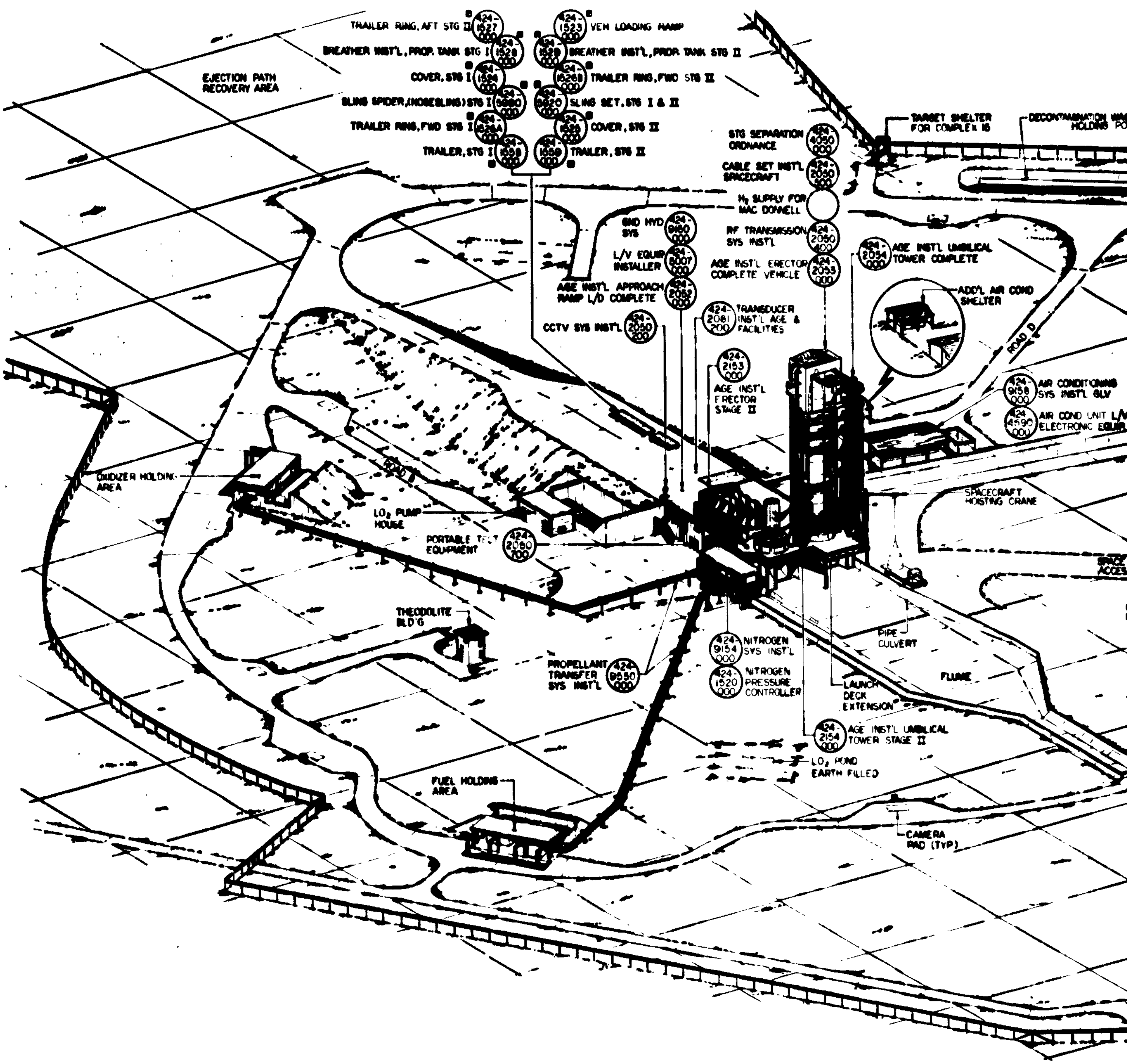


Fig. 12-1. Complex 19 at Cape Canaveral

1



TRAILER RING, AFT STG II
424-1527-000
BREATHER INST'L, PROP. TANK STG I
COVER, STG I
SLING SPIDER, (NOSESLING) STG I
TRAILER RING, FWD STG I
TRAILER, STG I
424-1523-000
VEH LOADING RAMP
BREATHER INST'L, PROP. TANK STG II
TRAILER RING, FWD STG II
SLING SET, STG I & II
COVER, STG II
TRAILER, STG II
EJECTION PATH RECOVERY AREA
STG SEPARATION ORDNANCE
424-4050-000
CABLE SET INST'L SPACECRAFT
424-2050-300
H_2 SUPPLY FOR MAC DONNELL
GND HYD SYS
424-9160-000
RF TRANSMISSION SYS INST'L
424-2050-400
L/V EQUIP INSTALLER
424-6007-000
AGE INST'L ERECTOR COMPLETE VEHICLE
424-2053-000
AGE INST'L APPROACH RAMP L/D COMPLETE
424-2052-000
AGE INST'L UMBILICAL TOWER COMPLETE
424-2054-000
TARGET SHELTER FOR COMPLEX 16
DECONTAMINATION WA
HOLDING PO
ADD'L AIR COND SHELTER
ROAD D
CCTV SYS INST'L
424-2050-200
TRANSDUCER INST'L AGE & FACILITIES
424-2081-200
424-2153-000
AGE INST'L ERECTOR STAGE II
AIR CONDITIONING SYS INST'L GLV
424-9158-000
AIR COND UNIT L/V ELECTRONIC EQUIP
424-4590-000
OXIDIZER HOLDING AREA
ROAD B
LO_2 PUMP HOUSE
PORTABLE TEST EQUIPMENT
424-2050-700
SPACECRAFT HOISTING CRANE
THEODOLITE BLD'G
PROPELLANT TRANSFER SYS INST'L
424-9550-000
NITROGEN SYS INST'L
424-9154-000
NITROGEN PRESSURE CONTROLLER
424-1520-000
PIPE CULVERT
LAUNCH DECK EXTENSION
FLUME
AGE INST'L UMBILICAL TOWER STAGE II
424-2154-000
LO_2 POND EARTH FILLED
FUEL HOLDING AREA
CAMERA PAD (TYP)

2

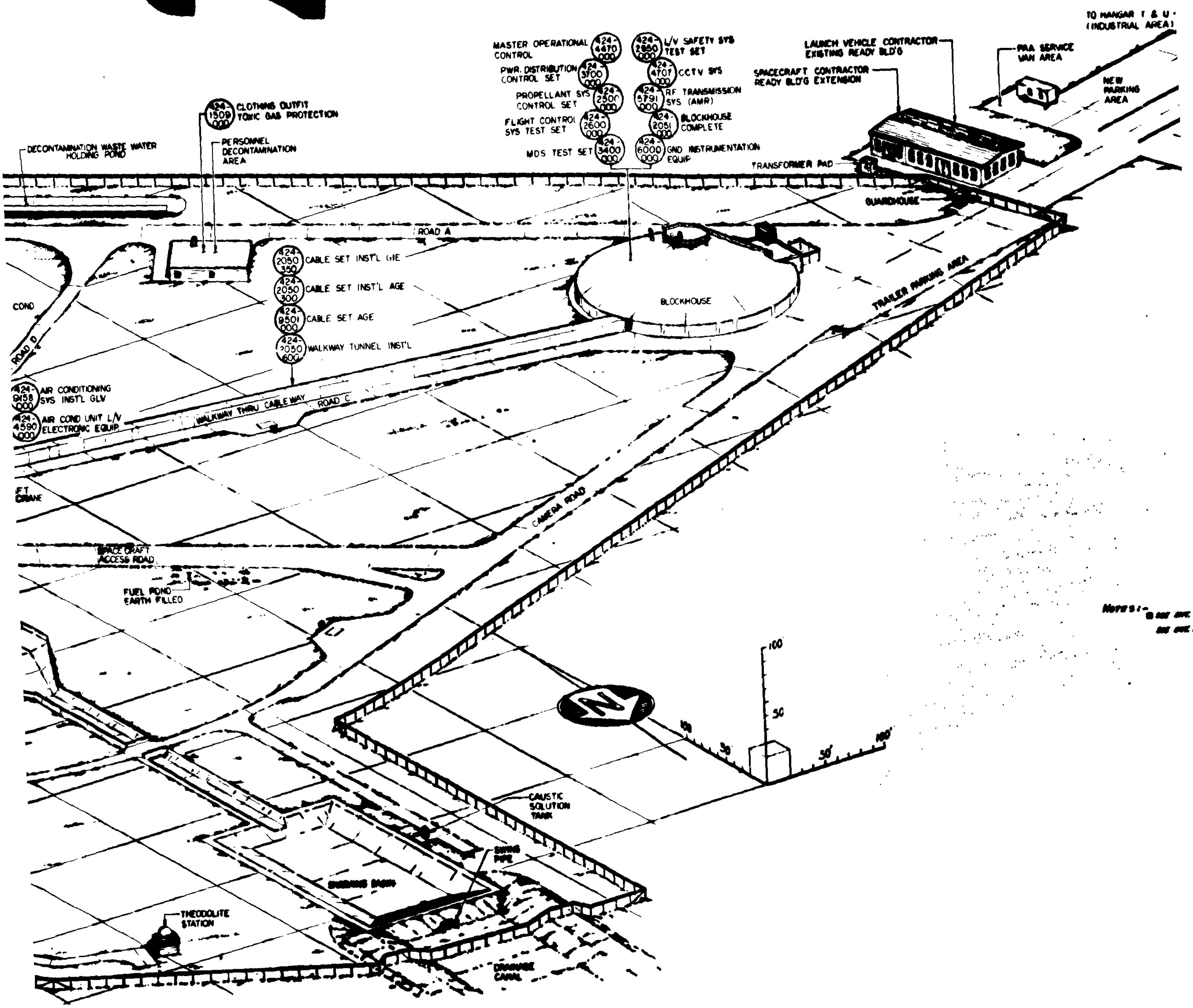


Fig. 12-2. Complex 19 and Assoc

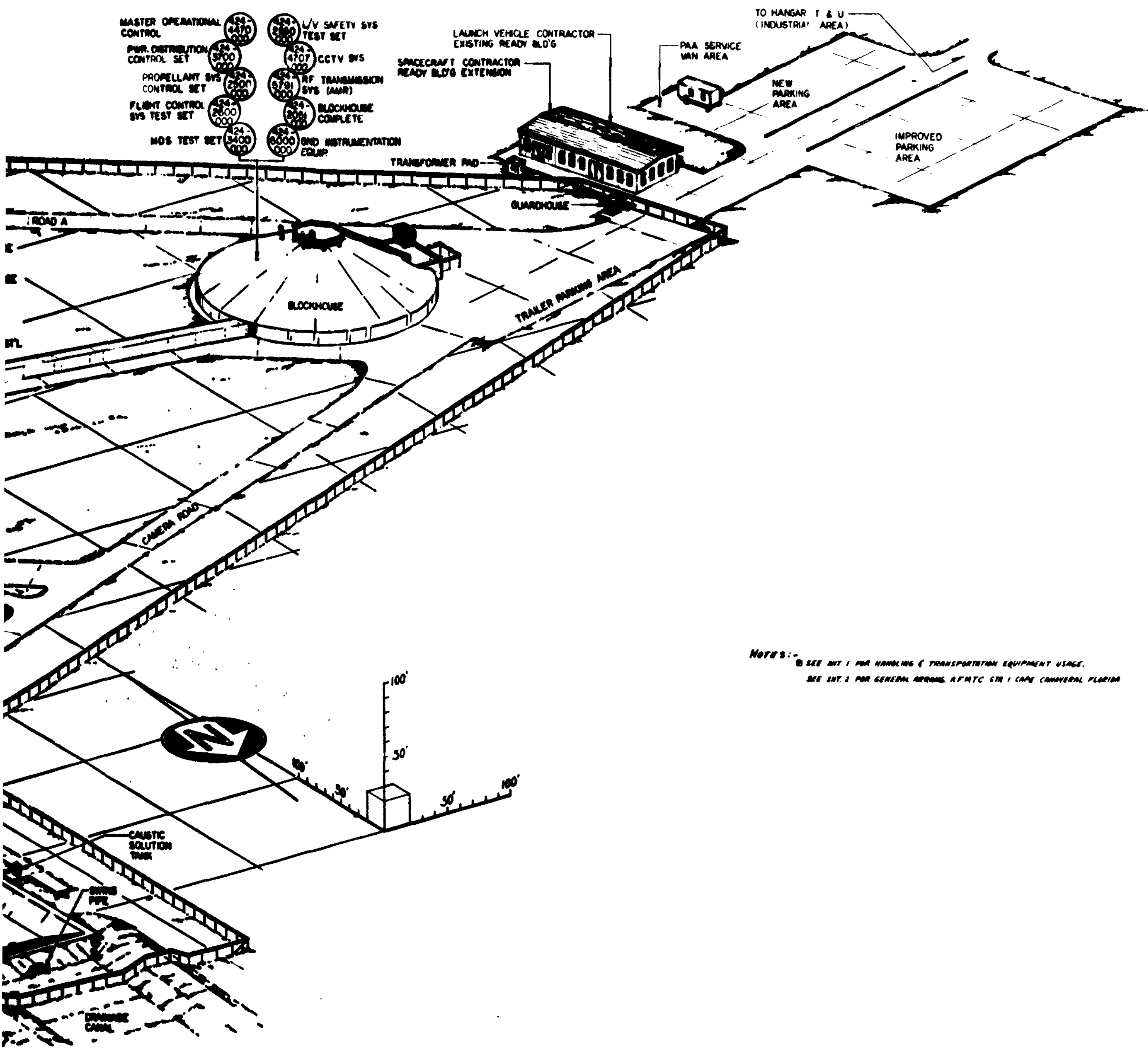
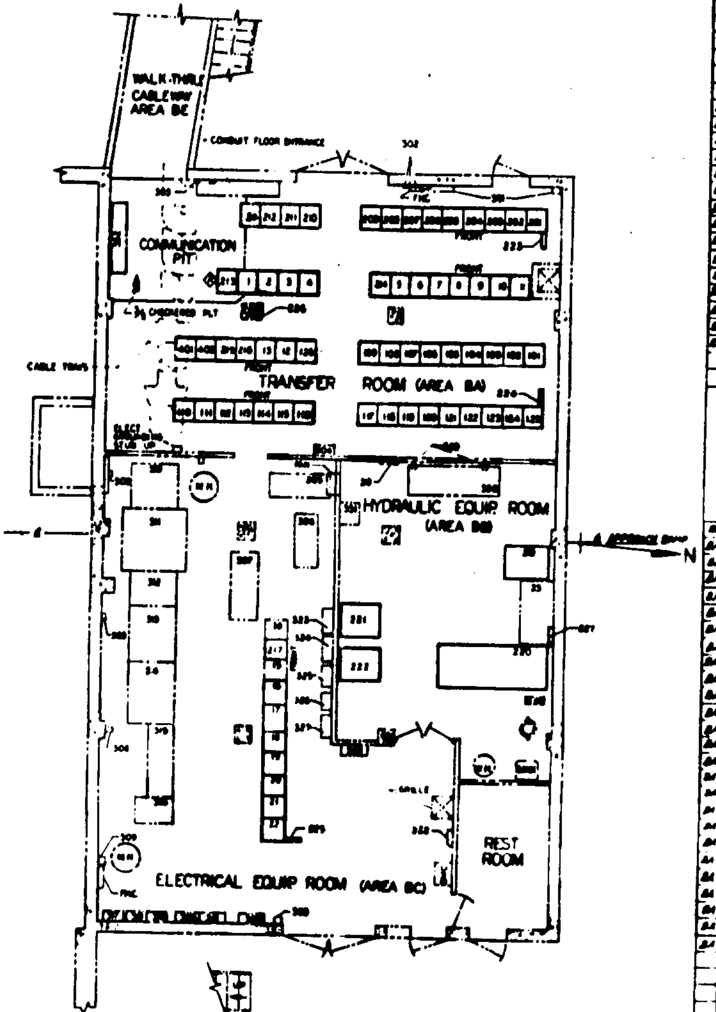


Fig. 12-2. Complex 19 and Associated AGE Installation

13.0 EQUIPMENT LAYOUT AND SPACE UTILIZATION

The locations of AGE units in the blockhouse and approach ramp equipment rooms are shown in Figs. 13-1 through 13-4. Figure 13-1 shows the equipment locations on the first floor of the approach ramp building; Fig. 13-2 shows the location of equipment on the second floor of the approach ramp building. Equipment locations on the first floor of the blockhouse are shown in Fig. 13-3 and the location of equipment on the blockhouse second floor is shown in Fig. 13-4.

Location numbers identifying the AGE units on the drawings correspond to location numbers used in the system installation descriptions.



PLAN VIEW
EQUIPMENT SPACE ALLOCATION (APPROACH RAMP BLDG FIRST FLOOR)
SCALE 1/8" = 1'
SEE ADJACENT LISTS FOR EQUIPMENT NOMENCLATURE

LAUNCH VEHICLE - AGE -

[illegible]	LOCATION NUMBER	DESCRIPTION	[illegible]	[illegible]
BA	201	AMR CABLE SET (TERMINATION RACK DRC2)		9501
BA	202	AMR CABLE SET (PATCH RACK AREA)		9501
BA	203	AMR CABLE SET (TERMINATION RACK DRC1)		9501
BA	204	AMR CABLE SET (TERMINATION RACK DRC3)		9501
BA	205	AMR CABLE SET (TERMINATION RACK DRC4)		9501
BA	206	ELECTRON [illegible]		6400
BA	207	PROPULSION CONTROL SET (RACK)	2043	2600
BA	208	AMR CABLE SET (TERMINATION RACK TDC4)		9501
BA	209	AMR CABLE SET (TDP)		9501
BA	210	AMR CABLE SET (TERMINATION RACK TDC4)		9501
BA	211	AMR CABLE SET (TERMINATION RACK TDC2)	4618	9501
BA	212	AMR CABLE SET (TERMINATION RACK TDC1)	4618	9501
BA	213	SPACE CRAFT SIMULATOR [illegible]		3300
BA	214	AMR CABLE SET (TERMINATION RACK TDC3)	4618	9501
BA	215	PROPELLANT SYS CONTROL SET (MONITOR RACK)	2041	2600
BA	216	MALFUNCTION DETECTION SYS TEST SET	3920	3900
BC	217	[illegible] SET	[illegible]	[illegible]
BB	218	HYDRAULIC HOSE ASSEMBLY KIT	50U6	
BB	219	HYDRAULIC PUMPING UNIT (PORTABLE)		5001
BB	220	HYDRAULIC [illegible] (CH)		7830
BB	221	MOBILE 28 VDC GND POWER SUPPLY		4793
BA	222	PORTABLE 28 VDC DUMMY LOAD		4797
BA	223	COUNTDOWN READOUT PANEL (ABOVE RACK)		4470
BA	224	" " " " "		4470
BC	225	" " " " "		4470
BA	226	" " " (ON SUPPORT COLUMN)		4470
BB	227	" " " (ON WALL)		4470
BC	228	" " " " "		4470
BA	101	PATCH RACK		6590
BA	102	PATCH RACK		6530
BA	103	JUNCTION PATCH RACK #2		6820
BA	104	RACK ASSY & T/C REF JUNCTION (RACK)		6880
BA	105	JUNCTION PATCH RACK #1		6810
BA	106	PATCH RACK		6950
BA	107	PATCH RACK		6540
BA	108	PATCH RACK		6810
BA	109	VOLTAGE NETWORK SIG CONDITIONER (RACK)		6730
BA	110	SPARE RACK ASSY (SPARE RACK -29)		6200C
BA	111	HIGH FREQ PWR SUPPLY RACK (-9)		63[illegible]
BA	112	HIGH FREQ PWR SUPPLY RACK (-19)		6370B
BA	113	BRIDGE CALIBRATOR PWR SUPPLY		6700
BA	114	BRIDGE SIGNAL CONDITIONER RACK (9)		6390A
BA	115	BRIDGE SIGNAL CONDITIONER RACK (-19)		6390B
BA	116	BRIDGE SIGNAL CONDITIONER RACK (-29)		6390C
BA	117	SPARE RACK ASSY (SPARE RACK -39)		6200D
BA	118	TOTAL FLOW SIGNAL CONDITIONER RACK		6330
BA	119	FLOW RATE SIGNAL CONDITIONER RACK		6320
BA	120	SPARE RACK ASSY (SPARE RACK -59)		6[illegible]
BA	121	T/C SIGNAL CONDITIONER RACK		6360
BA	122	T/C BIAS SUPPLY RACK		6750
BA	123	T/C SIGNAL CONDITIONER RACK		6360A
BA	124	POT TRANSDUCER SIGNAL COND RACK		6990
BA	125	RF & VIDEO PATCH RACK		6890
BA	126	PWR DIST RACK		6970

FACILITY EQUIPMENT (NOT [illegible]

	LOCATION NUMBER	DESCRIPTION
BA	301	FACILITY JUNCTION BOX
BA	302	A/C CONTROL
BA	303	REMOTE CONTROL & SIGNAL CABIN[illegible]
BA	304	PANELBOARD ACS AC INSTRUMENTA[illegible]
BC	305	MSB 480/208 V TRANSFORMER
BC	306	ISB 480/208 V TRANSFORMER
BC	307	AIR COMPRESSOR
BC	308	FACILITY ELECTRICAL MISC
BC	309	MOTOR STARTER
BC	310	SUBSTATION 'T' INTERRUPTER
BC	311	SUBSTATION 'T' TRANSFORMER
BC	312	SUBSTATION 'T' INDUCTROL
BC	313	SUBSTATION 'T' SWITCHGEAR T[illegible]
BC	314	SWITCHBOARD 'TN'
BC	315	MOTOR CONTROL CENTER A
BC	316	SWITCHBOARD 'TE
BC	317	PANELBOARD EB (UTILITY [illegible]
BC	318	PANELBOARD WB A/E RECEPTAC[illegible]
BC	319	PWB 277/480 PANELBOARD SEC
BC	320	PWB 277/480 PANELBOARD SEC
BC	321	EEB 277/480 PANELBOARD
BC	322	PANELBOARD ENB AGE RECEPT[illegible]
BC	323	RAMPS BATTERY HEATER XFER SWITC[illegible]
BC	324	ORDNANCE XFER SWITCH (TSW7)
BC	325	PANELBOARD DDS DC TRANSIENT [illegible]
BC	326	PANELBOARD DCS READINESS
BC	327	PANELBOARD DCF DC INSTRUMEN[illegible]
BC	328	PANELBOARD SNB AGE RECEPTA[illegible]
BB	329	FACILITY CONDUIT STUB-UPS
BB	330	AIR CONDITIONER
BB	331	[illegible] ACTUATOR CONSOLE
BA	332	TELEPHONE TERMINATION CABIN[illegible]

COMMUNICATIONS EQUIPMENT

	LOCATION NUMBER	DESCRIPTION
BA	401	CCEIA RACK
BA	402	CCEIA RACK

Fig. 13-1. Tran

2

	CONTROL POINT	END ITEM
[illegible] BRCI)		9501
[illegible]A)		9501
[illegible] BRC1)		9501
[illegible] BRC2)		9501
[illegible] BRC3)		9501
[illegible]		6400
	2043	2800
[illegible])		9501
		9501
[illegible] TBCO)		9501
[illegible] TBC2)	4618	9501
[illegible] TBC1)	4618	9501
[illegible]		3350
[illegible] TBC3)	4618	9501
[illegible] RACK)	2041	2600
[illegible]	3910	8400
[illegible]	[illegible]	[illegible]
[illegible]	EQUIG	
		5001
		7830
[illegible]		4793
[illegible]		4797
[illegible] RACK)		4470
"		4470
"		4470
[illegible]		4470
[illegible])		4470
		4470
		6800
		6830
		6840
		6880
		6810
		6850
		6860
		6880
[illegible]	—	6730
[illegible]		6800C
[illegible]		6370A
[illegible]		6370B
		6700
[illegible]		6340A
[illegible]		6340B
[illegible]		6340C
		6400
[illegible]		6200
[illegible]		6210
		6100-P
		6360A
		6780
		6900-A
[illegible]		6880
		6890
		6970

FACILITY EQUIPMENT (AGE ONLY)

	LOCATION NUMBER	DESCRIPTION	
BA	301	FACILITY JUNCTION BOX	
BA	302	A/C CONTROL	
BA	303	REMOTE CONTROL & SIGNAL CABINET	
BA	304	PANELBOARD LC3 AC INSTRUMENTATION	
BC	305	INB 110/208 V TRANSFORMER	
BC	306	IEB 110/208 V TRANSFORMER	
BC	307	AIR COMPRESSOR	
BC	308	FACILITY ELECTRICAL MISC	
BC	309	MOTOR STARTER	
BC	310	SUBSTATION 'T' INTERRUPTER	
BC	311	SUBSTATION 'T' TRANSFORMER	
BC	312	SUBSTATION 'T' INDUCTROL	
BC	313	SUBSTATION 'T' SWITCHGEAR (TSWF)	
BC	314	SWITCHBOARD 'TN'	
BC	315	MOTOR CONTROL CENTER 'A'	
BC	316	SWITCHBOARD 'TE'	
BC	317	PANELBOARD EB (UTILITY BUS)	
BC	318	PANELBOARD INB AGE RECEPTACLE	
BC	319	PNB 277/480 PANELBOARD SECT 1	
BC	320	PNB 277/480 PANELBOARD SECT 2	
BC	321	SEB 277/480 PANELBOARD	
BC	322	PANELBOARD ENB AGE RECEPTACLE	
BC	323	[illegible] BATTERY HEATER PWR SWITCH (TSWB)	
BC	324	ORDNANCE PWR SWITCH (TSW7)	
BC	325	PANELBOARD DCN DC TRANSIENT BUS	
BA	326	PANELBOARD DC3 READINESS	
BA	327	PANELBOARD DC3 DC INSTRUMENTATION	
BA	328	PANELBOARD SNB AGE RECEPTACLES	
BA	329	FACILITY CONDUIT STUB UPS	
BA	330	AIR CONDITIONER	
BA	331	ERECTOR ACTUATOR CONSOLE	
BA	332	TELEPHONE TERMINATION CABINET	

SPACE CRAFT - AGE -

		LOCATION NUMBER	DESCRIPTION	CONTROL POINT
	AA	1		
	BA	2		
	BA	3		
	BA	4		
	BA	5		
	BA	6		
	BA	7		
	BA	8		
	BA	9		
	BA	10		
	BA	11		
	BA	12		
	BA	13		
*	BC	14		
*	BC	15		
	BC	16		
	BC	17		
	BC	18		
	BC	19		
	BC	20		
	BC	21		
	BC	22		
	BA	23		
*	BA	24		

* NOT RESERVED

COMMUNICATIONS EQUIPMENT

	LOCATION NUMBER	DESCRIPTION	
BA	401	GEEIA RACK	
BA	402	GEEIA RACK	

1 [illegible]

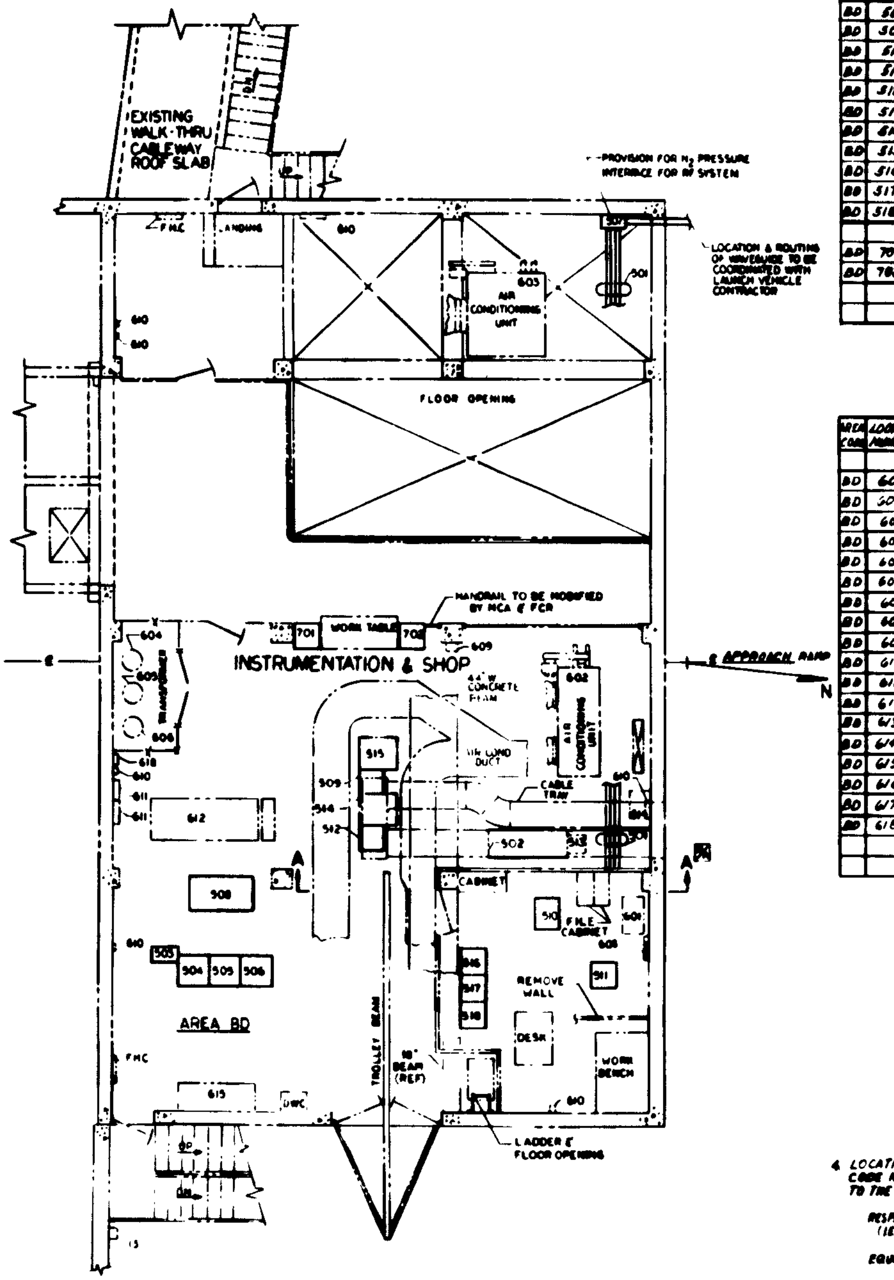
RESPECTIVE AREA [illegible]

EQUIPMENT LOCATION [illegible]

2 [illegible]

3 [illegible]

Fig. 13-1. Transfer Room and Lower Equipment Room, Approach Ramp Building



PLAN VIEW

EQUIPMENT SPACE ALLOCATION (APPROACH RAMP BLDG SECOND FLOOR)

SCALE ⅛" = 1'

SEE ADJACENT LISTS FOR EQUIPMENT NOMENCLATURE

LAUNCH VEHICLE - AGE -

AREA CODE	LOCATION NUMBER	DESCRIPTION	CONTROL POINT	END ITEM
BD	501	AMR RF TRANSMISSION SYSTEM		5701
BD	502	AMR CABLE SET (JUNCTION BOX)		9501
BD	503	28V STAND-BY BATTERY SYSTEM		4600
BD	504	450 AMP, 28VDC GRD PWR SUPPLY (RECTIFIER)		4795
BD	505	450 AMP, 28VDC GRD PWR SUPPLY (RECTIFIER)		4795
BD	506	450 AMP, 28VDC GRD PWR SUPPLY (RECTIFIER)		4795
BD	507	AMR RF TRANSMISSION SYSTEM		5701
BD	508	60 CPS PRECISE M/G SET		8810
BD	509	POWER DISTRIBUTION CONTROL SET (RACK)	3720	3700
BD	510	L.V. SAFETY SYS TEST SET (UMBILICAL MONITOR RACK)	2025	(2000)
BD	511	RADIO GUIDANCE CHECKOUT SET (FURNISHED BY G.E.)		[illegible]
BD	512	AMR CABLE SET (IPS/APS JUNCTION BOX)		9501
BD	513	AMR CABLE SET (IPS/APS BATT XFER SW-TSW		9501
BD	514	AMR CABLE SET (TRANSFER SWITCH RACK)		9501
BD	515	AMR CABLE SET (DCA SWITCHBOARD)		9501
BD	516	FLIGHT CONTROL SYS TEST SET (	2620	2600
BD	517	FLIGHT CONTROL SYS TEST SET (	2630	2600
BD	518	FLIGHT CONTROL SYS TEST SET (	2640	2600
		LAUNCH VEHICLE - INSTRUMENTATION AGE		
BD	701	AIS CHECKOUT EQUIPMENT (RACK)		6390.
BD	702	AIS CHECKOUT EQUIPMENT (RACK)		6390

FACILITIES EQUIP.
REFERENCE ONLY

AREA CODE	LOCATION NUMBER	DESCRIPTION	CONTROL POINT	END ITEM
BD	601	TRANSFORMER		
BD	602	AIR CONDITIONING UNIT		
BD	603	AIR CONDITIONING UNIT		
BD	604	15 KVA, ⌀ TRANSFORMER		
BD	605	15 KVA, ⌀ TRANSFORMER		
BD	606	15 KVA, ⌀ TRANSFORMER		
BD	607	A/C CONTROL		
BD	608	PWC 120/220 PANEL BOARD		
BD	609	MOTOR STARTER		
BD	610	FAC. ELECT EQUIP - MISC.		
BD	611	ICA PANEL SECTION 1&2		
BD	612	MOTOR CONTROLLER WINCH MOTOR		
BD	613	PHOTOELECTRIC RELAY		
BD	614	INTERCOMM. AMPLIFIER & MICROPHONE		
BD	615	COMMUNICATIONS EQUIPMENT		
BD	616	4NB TRANSFORMER		
BD	617	4NB PANEL BOARD		
BD	618	TRANSFER SWITCH (TSW II)		

4. LOCATION NUMBERS REPRESENT THE SPACE ALLOCATION CODE NUMBER. TO AVOID DUPLICATION, PREFIX THE AREA CODE TO THE SPACE ALLOCATION NUMBER. - EXAMPLE BD-501

RESPECTIVE AREA CODE PER (E) ON PG 4, SHT 1 (IE - APPROACH RAMP BLDG 2ND FLOOR)

EQUIPMENT LOCATION NO. (SEE PLAN VIEW)

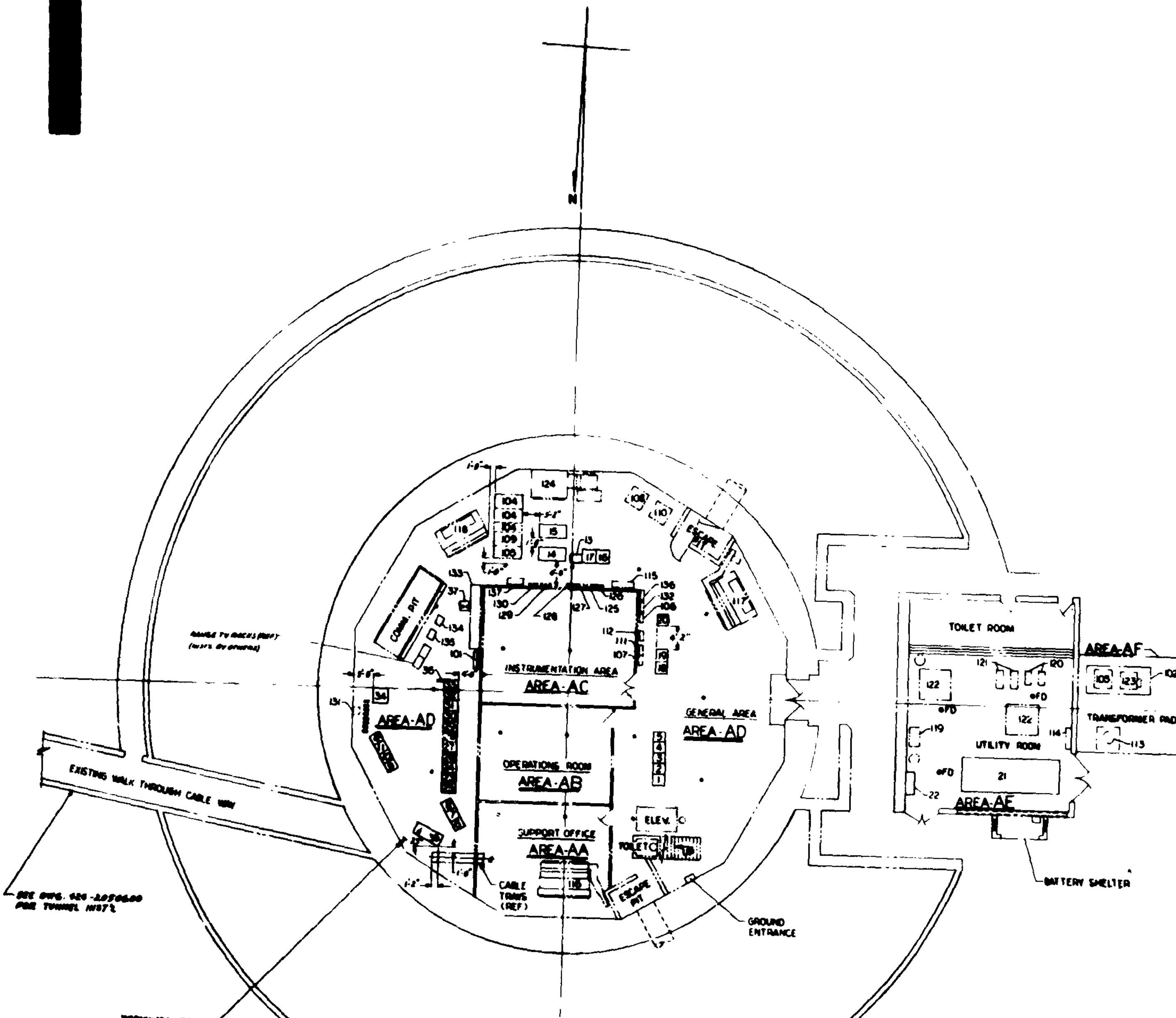
3. DIMENSIONS IN PLAN VIEW 2ND FLOOR ARE APPROX AS SHOWN

2. SEE SHEET FOR L/M AND GENERAL NOTES.

1. THIS DRAWING NOT COMPLETE WITHOUT SHEET 1

Fig. 13-2. Upper Equipment Room, Approach Ramp Building

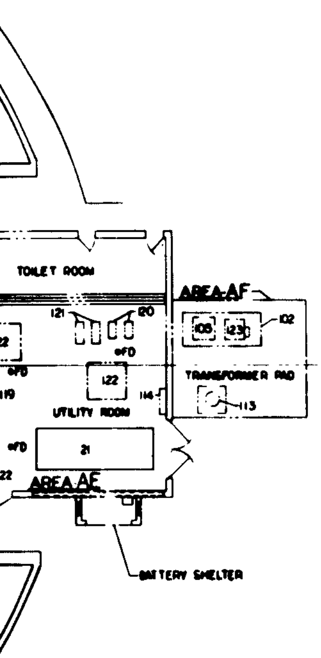
1



PLAN VIEW
EQUIPMENT INSTALLATION
1 ST FLOOR

SEE ADJACENT LISTS FOR EQUIP. NOMENCLATURE

2



	LOCATION NUMBER	DESCRIPTION	CONTROL POINT	
AD	1	RCA EQUIPMENT RACK		RCA-GPP
AD	2	MASTER SEQUENCER RACK - MILGO MOD 3	[illegible]	" "
AD	3	" " " " "	[illegible]	" "
AD	4	" " " " "	[illegible]	" "
AD	5	" " " " "	[illegible]	" "
AD	6	TERMINATION RACK (TBL1)	4618	
AD	7	" " (TBL2)	4618	
AD	8	" " (PP1)	4617	
AD	9	" " (TBC1)	4618	
AD	10	" " (TBC2)	4618	
AD	11	" " (TBP3)	4618	
AD	12	" " (TBP1)	4618	
AD	13	READINESS BATTERY AND CONTROL BOX	6509	
AD	14	AC INSTR. MOTOR GENERATOR-NORMAL PWR (MG-2)	2310	
AD	15	" " " " " " (MG-1)	2310	
AD	16	POWER SUPPLY 450 AMP (TR-1 DC INSTR.)	4795	
AD	17	" " " " (TR-2 DC READINESS)	4795	
AD	18	RCA TIMING RACK		RCA-GPP
AD	19	" " "		" "
AD	20	EVENTS CONTROL RACK	4470	
AD	21	EMERGENCY DIESEL GENERATOR 350 KW	4501	
AD	22	DIESEL GENERATOR CONTROL PANEL (72W6)	4501	
▲ AD	23	SPACECRAFT TM-PCM		
▲ AD	24	" " "		
▲ AD	25	" " "		
▲ AD	26	" SIGNAL CONDITIONER		
▲ AD	27	" " "		
▲ AD	28	" ELECT. PWR. STANDBY BATTERY		
▲ AD	29	" " " " "		
▲ AD	30	" " " " "		
▲ AD	31	" COMMUNICATION		
▲ AD	32	" "		
▲ AD	33	" "		
▲ AD	34	" TAPE PREPARATION UNIT		
▲ AD	35	" "J" BOX		
AD	36	COUNTDOWN READOUT PANEL	4470	
AD	37	CHARGER-NI-CAD BATTERY 28V (STORED IN AGE'Y?)	4505	

FACILITY EQUIPMENT (REF. ONLY)

	LOCATION NUMBER	DESCRIPTION
AD	101	DC-125 VDC PANEL BOARD AND EQUIPMENT
AF	102	SUB STATION "C" (NORMAL POWER)
AF	103	REGULATOR 120 AMP 100 KVA
AD	104	SWITCHBOARD "C" (NORMAL PWR) AND TRANSFER SW
AD	105	" "CE" (ESSENTIAL BUS)
AD	106	PANELBOARD 1BA (AGE UTILITY)
AD	107	" 2AA (AGE RECEPTACLES)
AD	108	TRANSFORMER 112 KVA (AGE UTILITY)
AD	109	SWITCHBOARD "CH"
AD	110	TRANSFORMER - MISC. UTILITY
AD	111	PANELBOARD 1HA (AGE RECEPTACLES)
AD	112	" 2HA (" ")
AF	113	TRANSFORMER STREET LTS. 25 KVA
AE	114	MOTOR CONTROL CENTER (SPACE AC PWR)
AD	115	" " " PWR (AIR HANDLING PWR)
AD	116	AIR HANDLING UNIT 1
AD	117	" " " 2
AD	118	" " " 3
AE	119	AIR COMPRESSOR
AE	120	CHILLED WATER PUMP
AE	121	CONDENSER PUMP
AE	122	WATER CHILLERS A/C COMPRESSOR
AF	123	TRANSFORMER, 500 KVA
AD	124	AIR PURIFIER
AD	125	PANELBOARD DC1 DC INSTRUMENTATION (NE)
AD	126	" DC2 READINESS
AD	127	" HC1 (NOT USED)(FACILITY SPARE)
AD	128	" LC1 AC INSTRUMENTATION (NE)
AD	129	" LC2 " " "
AD	130	ICB 120/208 PANELBOARD
AD	131	WARNING "J" BOX
AD	132	PANELBOARD 2EA
AD	133	STANDBY BATTERY RACK
AD	134	GE/IA RACK
AD	135	" "
AD	136	PANELBOARD 3BA (FUTURE SPACE PROVISION)
AD	137	SWITCHBOARD "CB"

4. LOCATION NUMBERS REPRESENT THE SPACE ALLOCATION CODE NUMBER. TO AVOID DUPLICATION, PREFIX THE AREA CODE CODE TO THE SPACE ALLOCATION NUMBER --EXAMPLE AD-101
AREA CODE (1st. B/H 1st FLOOR-CONTROL AREA)
EQUIPMENT LOCATION NUMBER (SEE PLAN VIEW)

3. DIMENSIONS IN PLAN VIEW OF B/H ARE APPROXIMATE AS SHOWN.

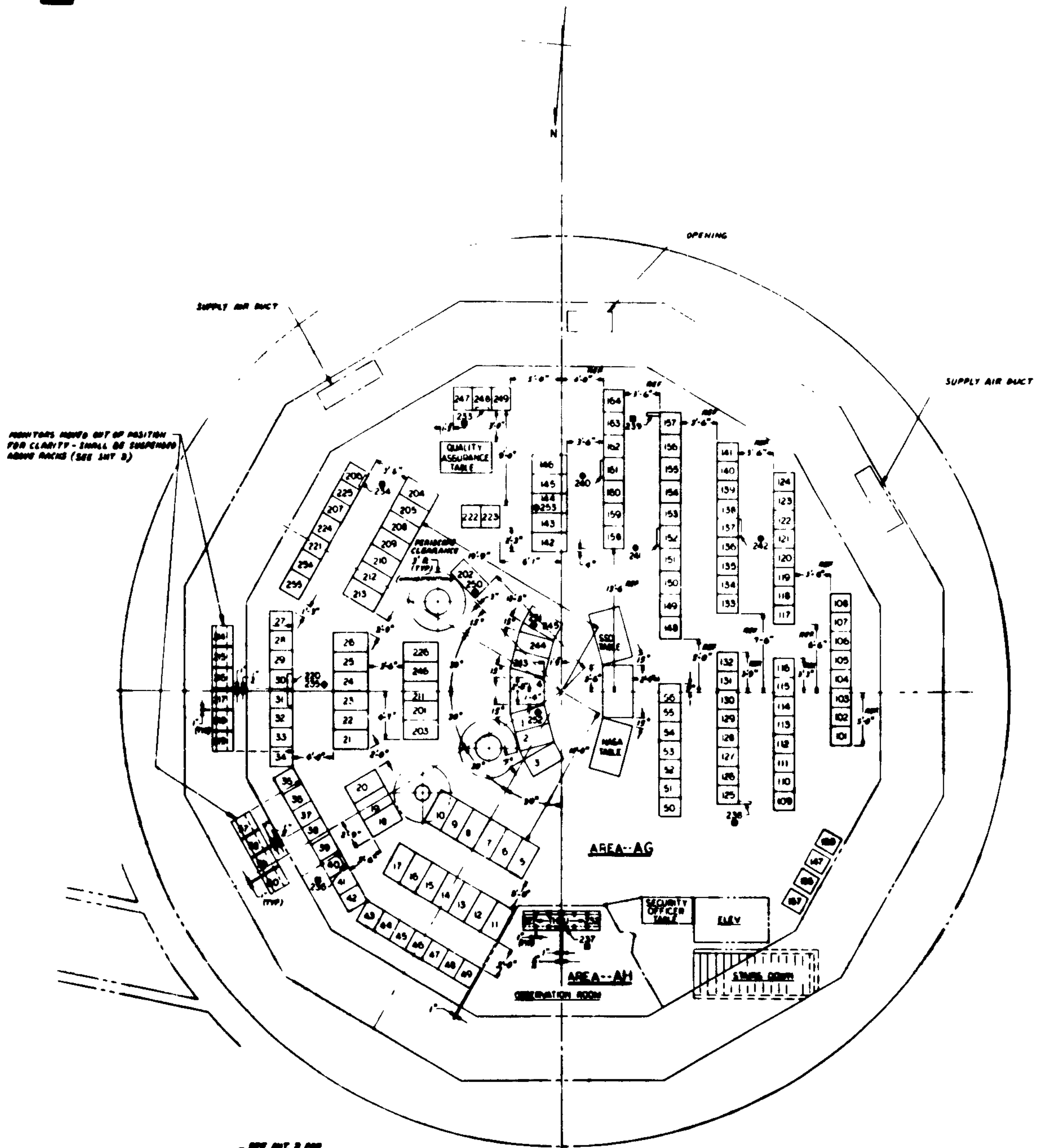
2. SEE SHEET 1 FOR L/M AND GENERAL NOTES.

1. THIS DWG. NOT COMPLETE WITHOUT SHEET 1.

NOTES:

Fig. 13-3. Blockhouse--First Floor

1



PLAN VIEW
EQUIPMENT INSTALLATION
2 ND. FLOOR

SEE ADJACENT LISTS
FOR EQUIP. NOMENCLATURE

SCALE NOTED

LAUNCH VEHIC

AREA CODE	LOCATION NUMBER	DESCRIPTION
AG	101	SPARE RACK ASSEMBLY (-5
AG	102	OSCILLOGRAPH RECORDER
AG	103	SPACE PROVISION
AG	104	SECONDARY POWER DISTR
AG	105	MAIN POWER DISTRIBUTION
AG	106	POWER MONITOR #2 RACK
AG	107	" " #1 "
AG	108	FM/FM DISCRIMINATOR ATT
AG	109	SPARE RACK ASSEMBLY (-5
AG	110	" " " (-1
AG	111	ACCESSORY RACK ASSEMBLY
AG	112	AMPEX RECORDER RACK - PRIMA
AG	113	" " " - SECON
AG	114	" " " - PRIMA
AG	115	" " " - SECON
AG	116	TIME DISTRIBUTION RACK
AG	117	FM/FM GRD. STA (MULTICOU
AG	118	" " " (RECEIVER
AG	119	" " " (PATCH RAC
AG	120	" " " (DISCRIMINA
AG	121	" " " "
AG	122	PATCH RACK
AG	123	" "
AG	124	" "
AG	125	VOLTAGE CONTROLLED OSCIL
AG	126	" " "
AG	127	" " "
AG	128	" " "
AG	129	" " "
AG	130	" " "
AG	131	" " "
AG	132	" " "
AG	133	SPACE PROVISION
AG	134	" "
AG	135	FM/VIDEO RECORDER (6 BI
AG	136	" "
AG	137	FREQUENCY METER RACK (
AG	138	SANBORN DIRECT WRITER
AG	139	" " "
AG	140	" " "
AG	141	" " "
AG	142	INSTRUMENTATION CONSO
AG	143	" "
AG	144	" "
AG	145	" "
AG	146	" "
AG	147	OSCILLOSCOPE TEST CART
AG	148	STRIPCHART RECORDER WIT
AG	149	" " "
AG	150	" " "
AG	151	" " "
AG	152	" " "
AG	153	" " "
AG	154	" " "
AG	155	" " "
AG	156	" " "
AG	157	" " "
AG	158	SPACE PROVISION
AG	159	MEASUREMENTS & EVENTS REC
AG	160	STRIPCHART RECORDER
AG	161	" " "
AG	162	" " "
AG	163	" " "
AG	164	" " "
AG	165	VOLTAGE CONTROLLED OSCIL
AG	166	TEST CART
AG	167	GENERAL TEST CART (-5)

2

AIR DUCT

EQUIPMENT LIST NOMENCLATURE

LAUNCH VEHICLE -AGE- (INSTRUMENTATION)

AREA CODE	LOCATION NUMBER	DESCRIPTION	CONTROL POINT
AG	101	SPARE RACK ASSEMBLY (-9)	6100A
AG	102	OSCILLOGRAPH RECORDER RACK (-19)	6150B
AG	103	SPACE PROVISION	
AG	104	SECONDARY POWER DISTRIBUTION RACK (-19)	6230
AG	105	MAIN POWER DISTRIBUTION RACK (-29)	6220
AG	106	POWER MONITOR #2 RACK	6250
AG	107	" " #1 "	6240
AG	108	PAM/FM DISCRIMINATOR ATTENUATOR RACK (-9)	6760
AG	109	SPARE RACK ASSEMBLY (-9)	6100A
AG	110	" " " (-19)	6100B
AG	111	ACCESSORY RACK ASSEMBLY (-9)	6030
AG	112	AMPEX RECORDER RACK-PRIMARY	6180
AG	113	" " " -SECONDARY	6210
AG	114	" " " -PRIMARY	6180
AG	115	" " " -SECONDARY	6210
AG	116	TIME DISTRIBUTION RACK	6210
AG	117	PAM/FM GRD. STA. (MULTICOUPLER & TEST)	6660
AG	118	" " " (RECEIVER RACK) (-10)	6670
AG	119	" " " (PATCH RACK) (-19)	6690
AG	120	" " " (DISCRIMINATOR RACK)	6640
AG	121	" " " " " (-19)	6630
AG	122	PATCH RACK	6500
AG	123	" "	6490
AG	124	" "	6480
AG	125	VOLTAGE CONTROLLED OSCILL. RACK (-9)	6190A
AG	126	" " " " (-19)	6190B
AG	127	" " " " (-19)	6190B
AG	128	" " " " (-9)	6190A
AG	129	" " " " (-19)	6190B
AG	130	" " " " (-19)	6190B
AG	131	" " " " (-9)	6190A
AG	132	" " " " (-19)	6190B
AG	133	SPACE PROVISION	
AG	134	" "	
AG	135	PCM/VIDEO DECODER (6 BIT QUICK LOOK)	6600
AG	136	" " "	6690
AG	137	FREQUENCY METER RACK (-9)	6401
AG	138	SANBORN DIRECT WRITER RACK ASSY (-29)	6170C
AG	139	" " " " " (-39)	6170D
AG	140	" " " " " (-9)	6170A
AG	141	" " " " " (-19)	6170B
AG	142	INSTRUMENTATION CONSOLE (-29)	6300C
AG	143	" "	
AG	144	" " (-9)	6300A
AG	145	" "	
AG	146	" " (-19)	6300B
AG	147	OSCILLOSCOPE TEST CART	6700
AG	148	STRIPCHART RECORDER WITH (DIGITIZER) (-9)	6410A
AG	149	" " " " (-19)	6410B
AG	150	" " " " (-9)	6410A
AG	151	" " " " (-19)	6410B
AG	152	" " " " (-29)	6410C
AG	153	" " " (BLDG WIRE) (-9)	6510A
AG	154	" " " " (-19)	6510B
AG	155	" " " " (-19)	6510B
AG	156	" " " " (-29)	6510C
AG	157	" " " " (-19)	6510B
AG	158	SPACE PROVISION	
AG	159	MULTIPOINT & EVENTS RECORDER RACK	6120
AG	160	STRIPCHART RECORDER RACK (-9)	6400A
AG	161	" " " (-19)	6400B
AG	162	" " " (-19)	6400B
AG	163	" " " (-29)	6400C
AG	164	" " " (-19)	6400B
AG	165	VOLTAGE CONTROLLED OSCILLATOR TEST CART	6720
AG	166	TEST CART	6800
AG	167	GENERAL TEST CART (-9)	6800A

LAUNCH VEHICLE -AGE-

AREA CODE	LOCATION NUMBER	DESCRIPTION	CONTROL POINT	END ITEM
AG	201	CLOSED CIRCUIT TV CONSOLE		4707
AG	202	PAD SAFETY OFFICER CONSOLE		
AG	203	TAPE RECORDER SYS CONSOLE (-9)	2801	
AG	204	POWER DISTRIBUTION CONTROL SET CONSOLE	3720	3700
AG	205	" " " " "		
AG	206	" " " " RACK	3720	3700
AG	207	RADIO GUIDANCE CHECKOUT SET RACK	9520	
AG	208	FLIGHT CONTROL SYS. TEST SET CONSOLE	2610	2600
AG	209	" " " " " "	2610	2600
AG	210	" " " " " "	2610	2600
AG	211	ERECTOR CONTROL CONSOLE	4472	4470
AG	212	PROPELLENT SYS. CONTROL SET CONSOLE (-9)	2881	2500
AG	213	" " " " "		
AG	214	LAUNCH VEHICLE CCTV MONITOR (ABOVE RACK)		4707
AG	215	" " " " "		4707
AG	216	" " " " "		4707
AG	217	" " " " "		4707
AG	218	" " " " "		4707
AG	219	" " " " "		4707
AG	220	TIME DISPLAY BOARD (-9)		4526
AG	221	PROPULSION CONTROL SET RACK (-9)	2031	2800
AG	222	LAUNCH VEHICLE SAFETY SYS. TEST SET RACK (-29)	2951	2950
AG	223	COMMAND RECEIVER CONTROL - MONITOR GRP. RACK	2851	2850
AG	224	SPACE PROVISION		
AG	225	" "		
AG	226	MALFUNCTION DETECTION SYS. TEST SET CONSOLE	9610	9600
AH	227	LAUNCH VEHICLE CCTV SLAVE MONITOR		4707
AH	228	" " " " "		4707
AH	229	" " " " "		4707
AH	230	" " " " "		4707
AH	231	" " " " "		4707
AH	232	" " " " "		4707
AG	233	COUNTDOWN READOUT PANELS (ABOVE RACK)		4470
AG	234	" " " "		4470
AG	235	" " " (IN TIME DISPLAY BOARD)		4470
AG	236	" " " (ABOVE SR RACK)		4470
AH	237	" " " (ABOVE TV MONITORS)		4470
AG	238	" " " (ABOVE RACK)		4470
AG	239	" " " " "		4470
AG	240	SHUTDOWN SWITCH (BOTTOM OF RACK)	4481	4470
AG	241	" " " "	4481	4470
AG	242	" " " "	4481	4470
AG	243	LAUNCH VEHICLE TEST CONDUCTOR CONSOLE		
AG	244	" " ASSISTANCE TEST CONDUCTOR CONSOLE	4471	4470
AG	245	SEQUENTIAL OPERATOR CONSOLE		
AG	246	PROCESS WATER CONTROL CONSOLE	4472	4470
AG	247	DLH EQUIPMENT	4585	6900
AG	248	" "	4570	6900
AG	249	" "	4564	6900
AG	250	COUNTDOWN READOUT PANEL (IN PAD SAFETY CONSOLE)		4470
AG	251	" " " (IN SEQ. OPER. CONSOLE)		4470
AG	252	" " " (IN SR TEST COND. CONSOLE)		4470
AG	253	" " " (IN INSTRU. CONSOLE)		4470
AG	254	CCTV RACK		4707
AG	255	" "		4707

□ INCLUDES [illegible] CONTROL POINT
○ FURNISHED BY GENERAL ELECTRIC

SPACECRAFT -AGE-

AREA CODE	LOCATION NUMBER	DESCRIPTION	CONTROL POINT
AG	1	SPACECRAFT TEST CONDUCTOR CONSOLE	
AG	2	" " ENGINEER "	
AG	3	ASTRO COMMUNICATION CONSOLE	
AG	4	TABLE	
AG	5	TELEMETERING CONSOLE	
AG	6	" "	
AG	7	AERO-MEDICAL CONSOLE	
AG	8	" " "	
AG	9	" " "	
AG	10	" " "	
AG	11	GUIDANCE CONSOLE	
AG	12	" "	
AG	13	" "	
AG	14	" "	
AG	15	" "	
AG	16	ENVIROMENTAL CONTROL SYS CONSOLE	
AG	17	" "	
AG	18	POWER & SEQUENTIAL CONSOLE	
AG	19	" " " "	
AG	20	" " " "	
AG	21	FUEL CELL CONSOLE	
AG	22	" " "	
AG	23	ORBITING ATTITUDE MANEUVERING SYS CONSOLE	
AG	24	" " " " "	
AG	25	COMMUNICATION CONSOLE	
AG	26	" "	
AG	27	" RECORDER RACK	
AG	28	" RACK	
AG	29	" "	
AG	30	" "	
AG	31	ORBITING ATTITUDE MANEUVERING SYS [illegible]	
AG	32	" " " " RACK	
AG	33	FUEL CELL RACK	
AG	34	" " RECORDER RACK	
AG	35	POWER & SEQUENTIAL RACK	
AG	36	" " " "	
AG	37	" " " "	
AG	38	" " " "	
AG	39	" " " "	
AG	40	ENVIRONMENTAL CONTROL SYS RACK	
AG	41	" " " RECORDER RACK	
AG	42	GUIDANCE RACK	
AG	43	" "	
AG	44	" "	
AG	45	" "	
AG	46	" "	
AG	47	" "	
AG	48	" "	
AG	49	" "	
AG	50	" RECORDER RACK	
AG	51	AUXILIARY RECORDER RACK	
AG	52	SPACECRAFT AUXILIARY RACK	
AG	53	" " "	
AG	54	PERFORMANCE VERIFICATION SYS. RACK	
AG	55	" " " "	
AG	56	" " " "	
AG	57	CCTV MONITOR (ABOVE RACK)	
AG	58	" " " "	
AG	59	" " " "	
AG	60	" " " "	

NOTE: LOCATION NUMBERS REPRESENT THE SPACE ALLOCATION CODE NUMBER. TO AVOID DUPLICATION PREFIX THE AREA CODE TO THE SPACE ALLOCATION NUMBER (PER AREA)

EXAMPLE AG-101
AREA CODE (B/H 2nd FL.)
EQUIPMENT LOCATION NO. (SEE PLAN VIEW)

4. DIMENSIONS APPROXIMATE AS SHOWN.
3. SEE SHT.3 FOR [illegible] & DETAILS.
2. SEE SHT.1 FOR L/O & GEN. NOTES.
1. THIS DWG NOT COMPLETE WITHOUT SHTS 1 & 3.

Fig. 13-4. Blockhouse--Second Floor